Benedetto Manganelli

Real Estate Investing

Market Analysis, Valuation Techniques, and Risk Management

Springer

Real Estate Investing

Benedetto Manganelli

Real Estate Investing

Market Analysis, Valuation Techniques, and Risk Management

Springer

Benedetto Manganelli
School of Engineering
University of Basilicata
Potenza
Italy

ISBN 978-3-319-06396-6 ISBN 978-3-319-06397-3 (eBook)
DOI 10.1007/978-3-319-06397-3

Library of Congress Control Number: 2014943417

Springer Cham Heidelberg New York Dordrecht London

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Contents

Chapter 1
The Real Estate Market

Abstract This chapter introduces the basic features of the real estate market. This is an imperfect highly segmented market. The segmentation is derived from the characteristics of traded goods. In order to understand the trend in the different submarkets, the following paragraphs analyse the trend patterns of stakeholders involved in the sale or purchase of property or in the use of a property. A classification of demand and supply is developed, identifying the main macroeconomic factors that affect these two functions and the interpretation about how they interact, is given.

1.1 Generalities on Property

The ownership and control of a building or any part thereof have always been considered fundamental actions of an individual's life. They fulfil a primary human need: that of their home or shelter for property, machines or animals.

However, changes in social habits have reduced the significance and importance always attributed to the dependence of people on the ownership of the land and of what artificially permanently insists on it. It occurs, in fact, that today an individual frequently decides—for cultural, social and especially economic reasons—to rent the apartment in which to live thereby giving up the possibility to get full control through the purchase of the property.

In addition, the individuals often work in offices, factories and stores that do not belong to him. The changing balance between primary needs and the way in which people manage to satisfy them, the new requirements that accompany the change in the lifestyle of people, have changed the attitude towards the control of the real estate.

It is true, however, that a building offers a very wide range of services and benefits, and the current primary needs mentioned above represent only a portion of those needs that individuals feel and that the building can meet. Therefore, the purpose for which many individuals, have the financial capacity, purchase real

B. Manganelli, *Real Estate Investing*, DOI 10.1007/978-3-319-06397-3_1

estate, in some cases does not depend on personal satisfaction of primary needs but instead responds to the need to preserve capital and make a profit.

In principle, there are thus two reasons that impel the economic player, household or company, to purchase an urban property:

- Benefit from a flow of services derived from the self-consumption of the property, when the building is used as a dwelling or is instrumental to production;
- Ensure a flow of future income when they consider the purchase of property as an investment.

Because of personal qualifications and aptitudes of the operator who exerts the demand for real estate, the reasons and the weight of the factors that determine the purchase of goods, change.

Economic reasons certainly influence consumer behaviour: income, the interest rate on loans, the level of taxation on transfer and possession. Sometimes, however, the demand for real estate for self-use can be affected by reasons of an extra-economic nature: sociological, psychological, technological, etc.

On the other hand, the investor has solely economic purposes. The portion of the demand for urban real estate that meets these goals is certainly influenced by the level of income, but it is mostly sensitive to changes in the real property and, above all, to the comparison of this performance with the profitability of alternative investments.

1.1.1 Economic Characteristics

The building, depending on the services or benefits that it offers, may be considered a consumer good or a capital good. In the first case, the use of the property meets the primary needs of the individual (home, workplace, etc.), and/or secondary needs, for example in the case in which the property is an expression of social status.

When the property contributes to the production of other goods or services it is an indirect good: the case of an industrial warehouse (instrumental factor of production) or an urban property from which a flow of income is expected. Property, therefore, should be considered as consumer goods or production depending on the economic agents that require them to conform to the behavioural pattern of the consumer or investor.

The usefulness and therefore the value of a building—like any other economic good—is directly proportional to the ability to meet the needs (i.e. the demand), and inversely proportional to the amount available (i.e. the supply).

A characteristic of any economic good is, among others, its limited nature.[1] If the good is the product of a transformation, as in the case of a building, the limited

[1] An economic good is that if it is available in limited quantities, accessible and tradable.

availability of its factors of production and/or the cost of production determine its scarcity; the latter does not depend on the limited availability of the same factors.

The building is the result of a production process in which, as economic factors distinguishable even when the process is completed, the land and what is built on it are involved.

The narrowness of the building is therefore closely related to the limited availability of land for building. This technical constraint depends on the location and the planning policies and therefore it cannot be overcome, at least not by factors internal to the market.

If the urban land is, on the one hand, limited, on the other hand, it is of unlimited duration (permanence of the land).

Due to these characteristics over time, urban land is subject to rent. The rented land is in turn distinguishable in a so-called differential part and in an absolute part. The former is generated by characteristics and physical requirements, technical and legal issues that make land more or less attractive on the market for construction purposes. That is, it depends on the quantity and the quality of urbanization and complementary services to the area, on the issue of concessions to build or on the inclusion of areas in the implementation plans. The absolute land rent, instead, is a function of external elements to the property, from which the cost-effectiveness to build in the current condition or the next future is derived. This type of rent depends therefore on the scarcity of the property and it is therefore typical of the land and not of what is built on it.

It is also true, however, that the land value will not be perpetually constant and neither will it increase over time. It is also true, however, that the value of land is not said to be either perpetually constant or even increasing in time. It may occur, for example, that changes in lifestyles determine the corresponding changes in the patterns of use of the land and a consequent devaluation of the same. Phenomena such as pollution of the environment can make it dangerous or impossible to live or to stay in a given area, so that an unusable asset has no value. It is right, thus, to think of the property as a good of long duration, but only on condition that in some way, their ability to satisfy human needs is not destroyed.

The use of a land is always the result of a combination of physical, regulatory, economic, and social conditions. Once the area has been transformed to be destined to a particular function, it is then difficult to convert its original function in an attempt to adapt it to changing tastes and the consequent new demands. The conversion process is always slow and expensive. It may sometimes require the demolition and reconstruction of the building. In most cases, therefore, the conversion cannot be restricted (poor convertibility). The limited possibilities of transformation over time of the buildings and their impossible spatial transformation inevitably make real estate very sensitive to changes in economic conditions and social context.

The fixed location of urban real estate, combined with the many possible diversification of a building or urban land, gives each real estate investment a unique character.

This is a first condition of imperfection of the real estate market, if one takes into account that one of the characters of the perfect market is precisely the homogeneity of assets traded in it.

Then, there are different economic implications related to the characteristic of immovability of buildings and land. Firstly, the market to which the general property belongs, cannot be considered national or global, but is a local market at times very limited in space. The fixity location can have positive or negative effects on the value. According to this characteristic property, values suffer significantly changing economic and social conditions in the area of location.

Thus, for example, in mountain villages which are subject to strong emigration, one can notice the devaluation of properties, even though fully technically efficient, whereas in urban areas, which were initially on the outskirts of a growing city, due to the effect of a so-called relative mobility—in time they become "relatively" more central—one can notice a steady growth in the value (advantageous position).

There is therefore a contrast between the physical immobility of buildings and the mobility of socio-economic context.[2] Therefore, if on one hand the fixed location accounts for the unique nature of each land, on the other, it strongly conditions its usefulness and the land value.

1.1.2 Land-Use Regulations and Economic Effects

When one buys a property, in addition to obtaining physical possession of the property, he acquires a number of legal rights that allow him to have, within certain limits, full control of the property: the exploitation of its resources, the possibility to transform, to sell, to lease or to offer it as guarantee.

The expenses incurred by an ordinary family for the purchase of a property are, throughout their lifespan, its major economic commitment. No other consumer good requires such a high investment. It is therefore frequently necessary to make use of complex financing instruments. On the other hand, since there are few entrepreneurs in possession of capital required to cover the full costs of a construction project, they normally apply for external financing.

Fortunately, for both the family and for those who wish to undertake a construction activity, real estate, being durable property with long or very long economic life, is considered a good guarantee for obtaining a loan.

Among the legal characteristics of the property, there is also its intended use impressed by the planning instruments. Within an urban area, the following main categories distinguish the possible destinations of private land: residential, productive (offices, hotels, etc.), commercial, industrial.

---

[2] It is said that the buildings are physically motionless in the physical but movable from an economic point of view.

There are also public destinations: roads, schools, gardens, squares, etc. These functions, private and public, are closely related. The use of land intended for a specific use (residences, offices, shops, etc.) gives rise to a series of ties to other properties in the same area. There is a complementary relationship between the different uses of land. This concept, defined interdependence of functions, explains that the value of each property also depends on the destinations that characterize the land surrounding it.

On the one hand, it is true that the value of land (private) also strongly depends on the accessibility (public streets, highways) and services (water, electricity, etc.), in other words the quality and density of the infrastructure and equipment accompanying the urban context in which it is placed. On the other hand, the presence of these accounts for, at least partially, an important component of the cost of production and the management of real estate: tax. It is the remuneration that the entrepreneur (even as only an investor) pays to the State (one of the inputs), which provides the services required for the implementation of the production.[3] The real estate is then subject—as shown below—to other fiscal charges not related to the production or transformation, but its management.

1.1.3 Extra-Economic Characteristics

Although this book focuses on the economic values of investment property, some considerations relating to particular social significances played by the house cannot be neglected. For the modern man, this is often the centre of a series of social relations in turn connected with historical and architectural factors, which sometimes take the foreground compared to the economic substance connected to the satisfaction of the primary need of a home.

1.1.4 The Real Estate Operators

The building product may be involved in a range of economic activities such as the construction/processing, property management, administration, selling, brokering, promoting, estimating the value, consulting, etc. All these activities acquire role and meaning in relation to the nature of the real estate: investment property (or instrumental) or consumer good. Obviously, the choice between the dual characters that distinguishes the property is a consequence of the economic activity

[3] The production as a creation of utility can be understood as material transformation (it is precisely the production building) or even temporal transformation or from person to person (real estate investment).

related to the possession or ownership of the same, the subject that performs this activity is therefore identifiable as an investor or consumer.

To understand which model can be associated with the behaviour of economic agents involved in the activities mentioned above, Table 1.1 shows a scheme that associates the operator to the function he attributes to the property and identifies the behavioural model.

The categories listed have therefore, in respect of the property, trends that can be very different, and these, depending on the circumstances, make it a good instrumental or consumer good.

Let us analyse the behaviour of those operators that normally constitute the most important component of housing demand: households (users-owners). These, on the one hand, see the purchase of a property as the satisfaction of a primary need and, on the other hand, consider the acquisition as a protection of their savings. Their choice is essentially conditioned by:

- Housing prices;
- The level of rentals;
- The interest rate for long-term financing.[4]

Coons and Glaze (1963), who claim that the maximum price payable for the purchase of property cannot exceed the accumulation of net rental obtainable by the same, have approximated the behaviour of this type of investor.

Although this accumulation appears to reflect the concept of capitalization value exactly as a procedure for the estimate of the market value of a property, this has absolutely no meaning. The assessment to which it refers is the convenience to purchase; therefore, it expresses a judgment value specifically valid on the characteristics of the investor and not generally valid as is the market value instead. The rate, at which rentals are discounted, is not in fact a market rate.

The following equation illustrates this behaviour:

$$P_d = \frac{Q_a}{(1+R_i)} + \frac{Q_{a_2}}{(1+R_i)^2} + \cdots + \frac{Q_{a_n}}{(1+R_i)^n}$$

where:

P_d demand price;
Q_a average estimated net rental during the expected life of the property;
R_i rate of interest of the capital market in the long term.

The demand price for the real investor is therefore determined by the average level of rentals (it represents the income of the investor in case it opts for purchase) and the rate charged on loans (which reflects the profitability of alternative

[4] The analysis of demand in the housing market involves, in addition to the parameters indicated, other variables that are subject to an in depth view in the following paragraphs.

Table 1.1 Economic operators in the real estate market

Economic operator	Function	Behavioural model
Leaseholder	It is pure consumers. NB: Sometimes the choice to be users (non-proprietary) may arise from economic reasoning	Consumer
User-owner	Enjoys real estate	Intermediate (behaviour varies depending on the motivations and economic situations)
Small owner real estate	He buys the property in order to derive an income, but also for reasons related to defining of the savings from inflationary effects, or for extra-economic reasons (a house for the children, etc.)	In this case the investor figure is prevalent
Real estate company	Its main objective is to derive an income from the rental of property	Investor
Real estate fund	A behaviour similar to the previous category with the variation that the property is added to a portfolio which may also contain equities	Investor

investments). The comparison between the demand price and the market determines the choice of the investor.

On the other hand, the value of the supply, which is the minimum price the seller is willing to accept for the sale can be considered equal to the accumulation of rentals, however, developed at a rate equal to the expected return from investment property. The following equation explains the price of supply:

$$P_o = \frac{Q_a}{(1+R_m)} + \frac{Q_{a_2}}{(1+R_m)^2} + \cdots + \frac{Q_{a_n}}{(1+R_m)^n}$$

where:

P_o price of the supply;
Q_a average estimated rental during the expected life-span of the property;
R_m marginal efficiency of capital invested in the case of purchase.

Users-owners will be in a position of indifference when $R_i = R_m$, and they prefer purchase to lease if $R_m > R_i$, and renting to purchase in the opposite case.

In the housing market, given its constantly changing conditions, it is frequently the transition from renting to purchase when one switches from $R_i > R_m$ to $R_m > R_i$. The opposite case is outstanding, and this confirms that the owner-user does not fully act as a pure investor.

In any case, the decision regarding the purely economic convenience of rental or purchase is assumed considering variables other than those mentioned. Some of them are related in particular to the property (the useful life of the property, the prediction of insurance costs, maintenance and taxes, etc.). Others are the general

conditions of the market (expectations of future prices and exchange services, etc.). Furthermore, the owner-user, also, can be conditioned by reasons of extra-economic nature that bring him closer to the figure of the consumer.

Decisions on buying, as already mentioned, are sometimes based on sociological and psychological issues. Acting under such pressures, one does not consider, in its economic spectrum, the possibility of using the savings in alternative forms of investment.

There are also many other reasons that demonstrate the non-involvement of the owner-user in the behavioural model of the pure[5] investor.

In order to frame the economic figure of the investor in real estate the following definition is given: the investor is the one who buys a property because of two possible benefits:

1. A stream of revenue resulting from the exploitation of productive property in a certain period;
2. The profit resulting from increases in value over time, the so-called capital gains.

When the purchase has as its main target, the return on capital gains, the time horizon is normally very short and the operation should be considered as real estate speculation and not as an investment.[6]

The possibility that the property will undergo an appreciation compared to the value of purchase (a capital gain[7]) depends, of course, on the holding period, the period for which, after purchase, it is expected to retain ownership of the property.

1.2 The Nature of the Real Estate Market

1.2.1 An Imperfect Market

The real estate market, for various reasons, it is not a perfect market,[8] but takes on connotations that make it near monopolistic market structure (oligopoly or monopolistic competition). Among the factors that contribute to the imperfection

[5] Reasons highlighted in the aforementioned research of Coons and Glaze.

[6] The concept of speculation comes from the word *speculari*, which means looking at things in order to take advantage of it, or even spying on the occasion (*speculari opportunitatem of Velleio Patercolo, the historian of Tiberius*). Only at the end of the eighteenth century the word speculation underwent a semantic shift, switch from intellectual to business vocabulary, to indicate the economic common sense attitude to observe the dynamics of formation of the wealth to gain an advantage (Lacaze 2008).

[7] In the event of loss is called *capital loss*.

[8] A market is perfect if it is characterized by strong competition and there are the following conditions: (1) there are a large number of buyers and sellers with the opportunity to undertake free negotiations, and (2) the good traded are of uniform quality, and (3) each operator has full knowledge of the characteristics of the asset.

of this market, as noted above, the greatest burden is undoubtedly due to the heterogeneity of the properties (for location, intended use, age, quality, size, etc.).

The imperfection of the real estate market, however, is also due to the lack of transparency of the mechanisms that generate prices and consequently the difficulty in obtaining complete information regarding the transactions. Another factor of inefficiency in the housing market is to be found in the characters of the supply. In fact, if the demand, although pushed by different motivations can be considered pulverized, the same cannot be said with regard to the supply.

In real estate market, it so happens that prices are not determined by the competition of a large number of operators interested in similar goods, but they tend to be set as a result of infrequent trades of property that may have very different characteristics, negotiated between interacting parties based on limited and often asymmetrical information.

Economists classify forms of market either according to the power that individuals have to influence prices, or depending on the speed with which new information is reflected on values. The real estate market has characteristics that set it midway between monopolistic competition (the existence of a number of competing operators that produce goods which are sufficiently distinct to allow the consumer more choice) and the oligopoly (few sellers and market conditions prevent the entry of new players in the supply). Inside, buyers and sellers have a price-searching behaviour.[9]

If a price-searcher has full knowledge of the characteristics of supply and demand and is aware of the costs of all the alternatives, the achievement of the objective (maximization of utility or profit) would be simplified. In practice, however, decisions must be made without having a perfect knowledge of the market conditions. In these cases, the time required for new information to be reflected in the prices, is a measure of the inefficiency of the market. If the market is less efficient then price-searching behaviour becomes most important.

The following paragraphs highlight the distinctive character of the real estate market and the reasons for its inefficiency or imperfection.

1.2.2 Segmentation

The real estate market can be considered as the complex aggregation of several submarkets distinguishable in relation to the factors that determine the demand and

[9] In an atomistic market, operators cannot affect prices through their activities: in this case, buyers and sellers must take the price (price-takers). Conversely, in a pure monopoly, the seller imposes the price and is, therefore, a price-maker. Between these extreme categories, there are markets where participants cannot fully control the prices, but they realize that their decisions affect them. The operators of such a market are therefore price-searchers.

supply and the manner in which the two functions interact.[10] Within these submarkets and within certain limits, a relative homogeneity of the product is conceivable. In fact, the fixed location makes the property unique.

The assets that belong to the same segment can be considered as a set of similar products, namely connected by an almost continuous "chain of sustainability", that compete in the search for the buyer through the price mechanism (Dandri 1969).

The degree of substitutability between two properties can be measured using the concept of cross-elasticity of demand. In other words, if the increase in the price of property *A* causes an increase in sales (and therefore demand) of property *B*, then *A* and *B* are substitutable goods (Triffin 1947). The greater the ratio between the variations of demands of *B* with respect to the change in the price of *A*, the greater the degree of substitution between the two properties.

In the real estate market, if the growth of property prices in a given area produces an increase in prices in another area, then these areas belong to the same submarket, the boundaries of which reach up to where the above-mentioned reactions are. The concept of substitutability is therefore essential in the delimitation of the homogeneous market and in the subdivision of urban land in submarkets. Looking at the mechanisms of the formation of values and rents shows that the most important segmentations are determined by location and destination. For example, with reference to single-family apartments for sale, the submarket is detectable in the neighbourhood or in a geographic area within which the changes that have been discussed have a direct and immediate effect on all properties in the area. However, the boundaries of a specific market are, in some cases, difficult to establish. Some submarkets have a very large spatial horizon or are at least blurred.[11] For certain destinations or types of buildings, the market could have a regional or national range.

In Table 1.2 some of the main characteristics that contribute to identifying a segment of the real estate market are defined in a hierarchical order.

Since properties are not homogeneous goods, the imposition of a threshold for a degree of substitutability allows for the identification of the different market segments. In relation to other characters, in addition to those listed, one can continue the segmentation of the market where this is requested by the particular purpose of the analysis.

[10] Specialist publications distinguish the individual markets for intended use (homes, offices, shops, etc.) and location (city and region), with an indication of the maximum and minimum prices per unit depending on the extrinsic, intrinsic, productive and technological characteristics.

[11] In order to identify homogeneous areas see Manganelli and Murgante (2012a, b), Manganelli et al. (2013).

Table 1.2 The main factors of the real estate market segmentation

Location	The quantity and quality of infrastructure and services, accessibility, environmental characteristics, social context, define the geographic boundaries of the market area
Destination of the property	Residential, commercial, offices, industrial, multi-service, etc.
Typology building	The distributive characteristics of functions within the property, its shape, its size, its architecture
Construction quality	Elegant, luxury, cheap, popular, etc.
Tenure status	The free real estate market should be distinguished from the leased real estate market

1.2.3 The Short and Long Period

In analysing the behaviour of sub-markets, some economists have distinguished a standing stock period and a construction period, namely a static phase and a dynamic phase. It is, of course, a purely conventional classification since in fact the market is never completely stopped.

The hypothesis is that in the static phase new buildings are not built and housing stock remains unchanged. The static phase coincides with the condition that economists call the short term, an interval during which the entrepreneur is not able to change the total factor productivity.

Taking into account that, in the short term, the availability of the production factor land is almost non-editable as well as the relative length of the transformation process construction,[12] variations occurring in the composition of the real estate as a result of the new buildings are minimal or negligible compared to the size of the same assets. To say, therefore, that in the short term (i.e. in the static phase) the supply is practically rigid is an acceptable approximation.[13]

In the static phase the prices and quantities traded (the number of transactions during the period) are thus essentially determined by the behaviour of potential buyers (demand).

[12] If reference is made to the times for the realization of a project, in the case of common constructions, this interval can be considered equal to 1 or 2 years. For more complex projects, one must imagine a greater number of years, and this period is then extended over time to obtain all the authorization and for the execution of procedures required to start the work and product marketing.

[13] The constraints on the supply lead to an increase in the volatility of the real estate market. These constraints are derived primarily from the administrative procedures that dramatically reduce the elasticity by increasing the time and costs of the construction transformation process. In addition to this constraint, the low availability of sites for the construction and the resulting under-investment relative to the size of the existing building patrimony, leaves less space for the supply response compared to increases in demand. Regulation and geographical constraints play critical and complementary roles in decreasing the responsiveness of investment to demand shocks, which in turn amplifies the volatility of house prices (Paciorek 2013).

The dynamic phase coincides with the medium to long term; the prices depend on the presence of new construction, from demolition and/or processing.

The explanation for any fluctuations in property values in the short term should therefore be related to changes in demand. As regards the demand should highlight two opposite behaviours that characterize the short period:

- The first, inelastic, due to the fact that the properties essentially satisfy the primary needs[14];
- The second is connected to the durable nature of the property, it therefore describes a higher reaction of the demand for real estate (more elastic) compared to the demand for primary commodities but not durable.

With reference to this attitude of the consumer, it is useful to note what Lipsey (1968) says:

> The greater short-term variability in consumption expenditures is found in the category of durable goods (it is easier to postpone the purchase of durable goods for a few months). Purchases of durable goods seem to respond to the influence of various factors such as interest rates, the extent of the initial payment in cash and expectations of a change in income that do not affect purchases of non-durable goods. The above factors seem more important than the same income to explain the short-term variations in the purchase of durable goods.

1.2.4 Cycles in the Housing Market

Looking at the price index built on the current values of residences in the housing market, in Italy as well as in the United States, France or the United Kingdom (Fig. 1.1) a series of fluctuations in the medium to long term range, are obvious.

The term *cycle* refers to the recurrence of fluctuations that characterize the equilibrium of the real estate market, never stable.[15]

---

[14] The primary goods have inelastic behavior with respect to price changes, but the houses are not all the same and some of them should be considered luxury goods (holiday homes, for example). In this case, the situation changes radically: the demand for luxury goods is more affected by the changes in price as consumers, for their purchase, are more prone to spend with discretion.

[15] By a cyclical movement we mean that as the system progresses in, e.g. the upward direction, the forces propelling it upwards at first gather force and have a cumulative effect on one another but gradually lose their strength until at a certain point they tend to be replaced by forces operating in the opposite direction; which in turn gather force for a time and accentuate one another, until they too, having reached their maximum development, wane and give place to their opposite. We do not, however, merely mean by a cyclical movement that upward and downward tendencies, once started, do not persist for ever in the same direction but are ultimately reversed. We mean also that there is some recognizable degree of regularity in the time-sequence and duration of the upward and downward movements. There is, however, another characteristic of what we call the trade cycle which our explanation must cover if it is to be adequate; namely, the phenomenon of the crisis—the fact that the substitution of a downward for an upward tendency often takes place suddenly and violently, whereas there is, as a rule, no such sharp turning-point when an upward is substituted for a downward tendency (Keynes 1936).

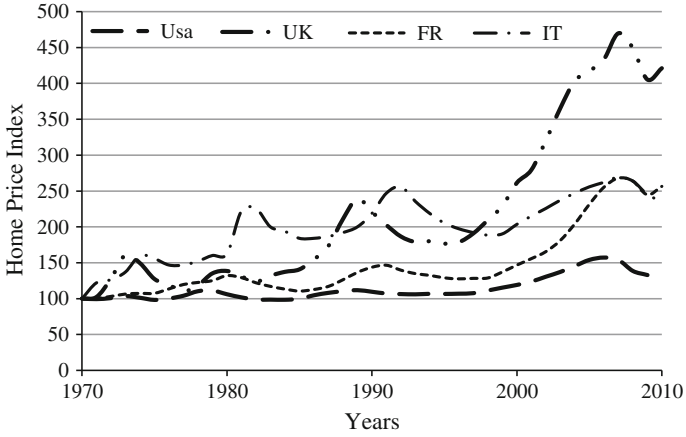


Fig. 1.1 Prices of residential property registered in the USA, the United Kingdom, France and Italy, 1970–2010

A proof of the cyclical nature of the real estate market is also the diagram in Fig. 1.2, which relates the relative property price index to the market of residences in Italy with the corresponding index representing the number of transactions (NTN).

In the model honeycomb, represented by Figs. 1.2 and 1.3 it is possible to identify four phases. In the first prices are stable but the number of transactions grows. Namely, in this phase the price is lower compared to a hypothetical equilibrium condition.

Demand has perception of this condition. The growth in demand is also the consequence of a supply, which leaves the prices unchanged.

In the second part, the supply, taking into account the rigidity that characterizes it, reacts to the increase in demand and prices begin to rise. The increase in prices and high profits that are generated, attract new investors and encourage the old to take advantage of the favourable moment. New constructions are started, in an attempt to capture the accumulated demand.

The application and the buoyancy of the market attract the attention even of those who buy without experience, driven by euphoria.[16] A peak condition is rapidly approaching, in which the property is overvalued; the real estate bubble is in full.

In the third phase of the property cycle, a slow decline in the value of property begins. The supply, which was very high due to the high demand that was present on the market, is at its maximum and tries to resist a sharp decrease in the number of transactions. It is the most risky phase of the market cycle. Demand is no longer

[16] Shiller (2007) speaks of extravagant expectations of future price increases, which spread like a social epidemic.

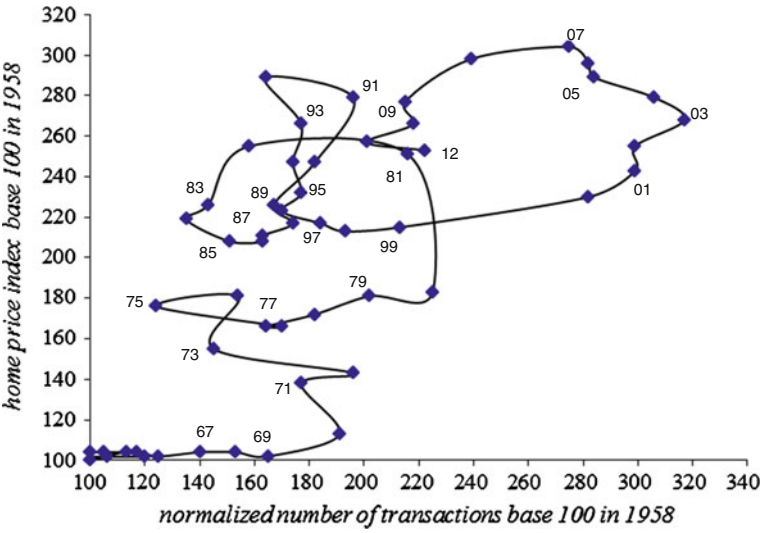


Fig. 1.2 Graph related to housing in the semi centres of cities in Italy 1958–2012 (*Source* Scenari Immobiliari)

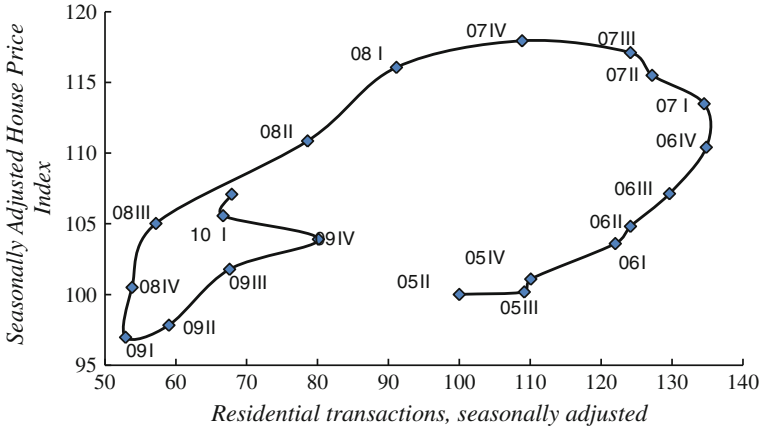


Fig. 1.3 Graph related to quarterly data of housing market in France 2005–2010 (*Source* Conseil général de l'Environnement et du Développement durable)

able to match the amount of new properties which have entered the market, and not at the high prices they were originally quoted at.

In the fourth stage, the value of property drops at a very fast rate and demand for property begins to drop significantly. People involved in the property market—namely buyers, sellers, investors etc.—become aware of the overvaluation of real estate prices and in the descending phase, they are placed on hold for further reductions. The fear of the decline in the property market leads to many people

backing out of investment in property. The few buyers who are still involved in property transactions can choose between numerous alternatives to buying property. The prices remain low until the excess supply is exhausted and at this point, the market begins to grow to the next peak.

The imperfection of the real estate market contributes to the perpetuation of this cycle. The lack of information and the length of time it takes to construct new property contribute significantly towards the imperfection in the property market.

Of course, many other factors can affect the nature of the cycle or the amplitude of its peaks. For example, the tax changes and the changes in interest rates at the beginning or end of a recession (Nneji et al. 2013) can have major positive and negative effects on the property market. In particular, the weight of these variables is analysed in detail in the following paragraphs.

The phases described above are proof of how the real estate market is distant from the conditions of a perfect market in which the interactions between demand and supply act so as to move the market around a hypothetical point of equilibrium in clockwise rotation. This rotation therefore has the opposite direction to the one described in the housing market.

The "cobweb model" describes this dynamic in the perfect market. It shows that—under certain assumptions—the achievement of a state of equilibrium is the result of the interaction between supply and demand. This interaction produces successive adjustments of the price and the quantity traded. The basic assumptions of this model states that production decisions are made at generic time t, assuming that the market price at the time is $t + 1$ (the actual time of the supply) is equal to that at time t. In fact, at time $t + 1$ the demand reacts to the new quantities offered thus causing an instantaneous change of the price. So for prices below or above a hypothetical equilibrium condition, the supply reacts, albeit with some delay, reducing or increasing the production.

In the real estate market due to the increased rigidity of supply, demand is the first to react. The supply, less reactive, is subordinated to the demand. It is the perpetual pursuit of demand, and the encounter between supply and demand is never a stable fact.[17] It should be emphasised however, that in spite of the cyclical fluctuations in the medium term that characterize all real estate submarkets, an increase in the value of property in the long run is observed.

The equilibrium condition around which the market revolves is not stationary. Iacoviello and Neri (2008) indicate that the growth of house prices measured in the long run is justified by the technological progress and the presence of land as a factor of building production. These two variables strongly influence the cost of production. As the supply is in turn closely linked to the cost of construction,

[17] The cobweb model also postulates that the encounter between supply and demand defines a condition of stable equilibrium in the neighborhood of the equilibrium point when the elasticity of demand exceeds the supply. Although in the real estate market the supply is certainly characterized by a greater rigidity than demand, as previously mentioned, the interaction of the forces at play does not produce convergence towards a stable equilibrium condition.

consistent with macroeconomic theory, it follows that the supply and the variables from which it depends produce variations in the equilibrium in the long run.

Unlike other categories of goods, the demand in the housing market, and not the costs of production, is the factor that most affects price and, within certain limits, the activities of the business operators (promoters, builders, designers, etc.). The final user, in other words the user of the property, is the one who controls the market through choices, movements, and budgets. Finally, it is useful to distinguish between the demand for housing, relatively more stable, and the demand for other types of real estate property. As a matter of fact, the construction of facilities for industry and commerce has a much more cyclical nature, since it is related to a derived demand.[18]

1.2.5 Supply Classification

The supply comes from various market operators (Fig. 1.4). A major part of it comes from the owners of land or buildings (the second-hand housing market) who decide to sell or dispose of their property, for reasons other than those related to production activity or investment.

Investors are also involved in the second-hand market when they buy property with the purpose of obtaining an income. Firstly, these individuals contribute to forming the demand for property then become the operator's supply of services (homes, offices, etc.). The other component of the supply is ultimately formed by the promoters, who actively participate in the building processes (construction companies, developers, lenders, owners of building sites, local authorities). Even the promoters operate indistinctively on the demand and the supply sides.

1.2.6 The Variables that Affect the Supply of Properties

Because of the long production cycle of real estate, the new buildings represent only a small part of the total supply, which instead is mostly identified with the existing building stock. The supply that stems from the production is a result of equilibrium between a market constraint (demand) and technical constraints (the cost of production). The part of the supply relating to the new building is therefore dependent on the cost of building production and in particular on the inputs that contribute to the production. They are:

[18] Houses are consumer goods, in the sense that they are purchased by individuals and not by businesses. About the properties that are not for self-use, it is said they have an indirectly or derived demand. This is the case of the cement used for the construction. Goods that have a derived demand tend to have a less stable pattern of demand with respect to property that is directly useful to the direct satisfaction of needs.

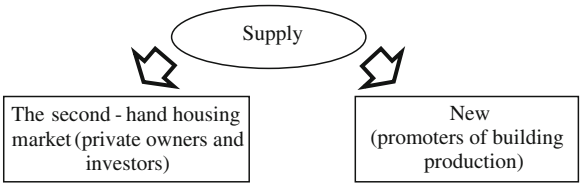


Fig. 1.4 Operators on the supply side

- The land factor;
- The capital factor;
- The labour factor;
- The entrepreneurial factor.

These factors correspond to the figures of the owner, the capitalist, the worker and the entrepreneur.

The land factor corresponds to the building sites. The value of a land is influenced by many parameters, some of which were already mentioned in the previous paragraphs. Without discussing the many economic theories on land rent, simply remember that the most important aspect of this factor is the geographical heterogeneity (there are no two identical properties): a difference of few meters, and therefore a shorter distance from certain services (schools, shops, offices, public transport, road networks) can lead to considerable changes in preferences and value.

These and other features of the property indicate the criteria that inspire transformation. Anticipating some topics that will be discussed in the following paragraphs, without prejudice towards the possibility of strategic choices and planning restrictions, it is clear that the market is the decisive factor in determining the best use of the land or of the building to be rebuilt. Furthermore, as regards the quantitative aspects, even before the planning regulations, the demand determines the amount of land required for the various urban functions.

The capital is identified with the necessary funding for the costs of real estate development. The capitalist is both the largest credit institution as well as the small investor who buys shares in real estate funds. Housing credit is overall intended to include the necessary liquidity to both the construction (short-term financing) and the purchase (long-term financing) of real estate.

The work is done both manually (workers) and intellectually (designers, managers, etc.), by a range of participants involved in the implementation of the investment project.

The entrepreneur allows for the implementation of the project by combining land, labour and capital and assumes the technical and economic risks of production.

Production varies in quantity and quality, on the one hand according to the demand (market constraint), and on the other in relation to the availability and cost of the factors mentioned (technical constraint). Cost and availability vary, according to rules that are peculiar to each of the same factors.

1.2.7 Demand Classification

In economics, the demand function expresses the inverse relationship that exists between the market price per unit and the amount of goods or services requested in a given period.

In the real estate market, within each area, the sales market should be distinguished from that of the rental market, in other words trade related to the sole right on the property, trade related to real estate destined for the sole enjoyment of the property itself.

In the housing market, demand comes from consumers interested in self-use of the property, but also by those who see an investment in the purchase of the property (Fig. 1.5). For those who see property as an investment, the buyer places himself within the rental market from the supply side. The market for rented housing in the form of those who require social housing, are interested in the use of the property (rent or concession) or operate in the rental market on the demand side, generates demand from investors in the sales market. The two markets, as it is better investigated in the following paragraph, are closely related.

1.2.8 The Determinants of the Demand for Real Estate

The demand for property is generated within a specific urban area by a number of factors that are not only economic but also social and cultural (Fig. 1.6). The need to consider the non-economic factors in the study of demand for property is especially appropriate when the focus is on the residential market.

Demand analysis also suggests the need to distinguish, amongst the non-economic factors, those affecting the operators interested in the self-use of the property (by purchase or rental) and those influencing the choices of those who requires property with the goal of obtaining an economic advantage (investors).

The demographic element of the property is one of the determining factors in the choice of property for use on behalf of owners/leaseholders etc. Changes in demand may result from changes in population and changes in the size of the housing. Families, not the individuals, are reference units as they are the first real consumers of real estate. Equally important is the information on the current and future family composition (number and age of the individuals, socio-cultural characteristics, income levels).

It is easy to see people who live alone create a very elastic demand, which is principally focused on the rental market, while the families of the elderly require special types of accommodation and building solutions.

It is also true, that the demographic factor cannot be separated from the economic factor. Variables such as the marriage rate and migration are evidently affected by economic cycles. Studies conducted in various countries have shown that the geographical areas in the economic development stage, always record an increase in immigration and the number of marriages (Li and Chand 2013).

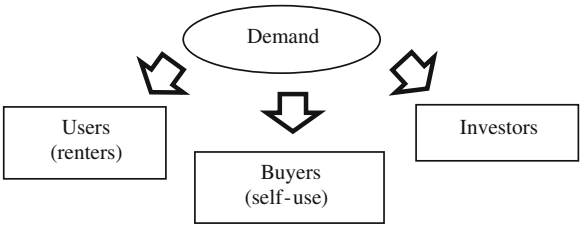


Fig. 1.5 Economic operators of demand

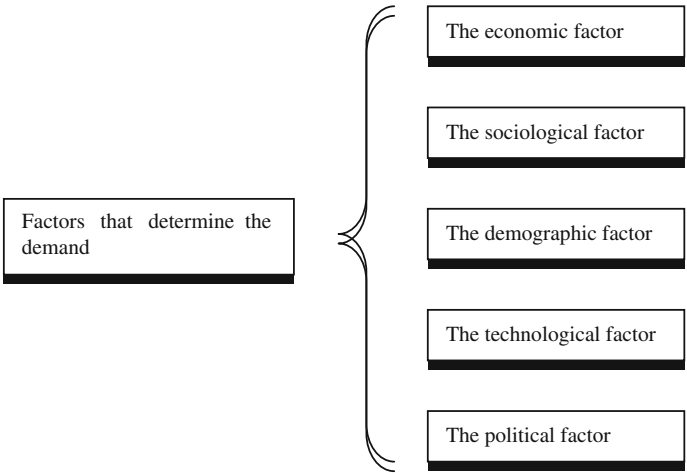


Fig. 1.6 Components of the demand for real estate

The demand for self-use is conditioned by the preferences and needs in terms of quality, features, size, type and location of the building product.[19] Sociological and cultural factors certainly influence needs, however the transformation and evolution of the needs are often induced by technological development and thus to economic factors. Technological innovation has direct and indirect consequences on the demand for real estate. The direct consequences of technological innovation are:

- The availability of new construction techniques or new functions;
- The improvement of transport systems that offer alternatives in location.

[19] Proof of the quality as a driver of demand can be provided by measuring the standard deviation of the real estate prices. With reference to the last expansion cycle of the property market cycle, which was accompanied by intense refurbishing and urban regeneration initiatives often implemented through the work of famous architects, it has been noticed that prices for all types of real estate tend to differentiate more and more around their average values.

Developments in medicine, agriculture, industry and communications have indirect effects on the housing market as well, as they are reflected on the demographic and sociological components.

However, with reference to the demographic phenomena, it is possible to speak of trends and cycles reducible to mathematical formulas, the same cannot be said for the technological and sociological phenomena.

Although there is no doubt that sociological phenomena and technological innovation produce an effect on the housing demand for quality, functionality and appearance of the individual buildings, as well as on the ways and the times of use of those buildings, it is equally true that it is not possible to predict the evolution of these phenomena or to quantify the consequences of technological or social changes, which would cause a change in the real estate market.

Demographic changes and preference changes have an impact on the housing market in the long run, whilst amongst the non-economic factors that can affect demand in the short and long term, one must consider the political-regulatory factor.

The Government has always identified social values with housing and, depending on the intended purposes (to facilitate the purchase of the house, encourage businesses, etc.), it puts in place actions, at times conflicting, which aim to promote either demand or supply. However, very often the uncertainty of the system of implementation of these actions and the consequent disorientation of economic operators dramatically reduces the desired effect. With reference to the legal-political factor, it should also be noted that administrative decisions on tax matters can facilitate both the demand for self-use (through subsidies for the purchase or deductions to the rentals) and that for investment purposes (for example, a change in the tax burden relative to income from property).

Demographic factors (birth rate, mortality, migration) affect mainly the amount of real estate globally necessary to accommodate the population, whereas the sociological and technological factors act mainly on the qualitative, positional and functional aspects of the product required, the economic ones are able to explain the inter-temporal variance of effective demand.

There are also elements of a local nature that may influence the demand for property and real estate services. The format of Table 1.3 lists the different factors that distinguish the demand from households from those arising from businesses. All those factors, which may lead to changes in domestic demand, have obvious direct or indirect impacts on the residential market, the spaces for the retail trade, housing and tourist accommodation. What influences the demand from businesses is reflected in the sub-markets of the areas for wholesale, for the tertiary sector (offices) and for industries.

It is obvious for example, that the sizing of the areas destined for the sale of consumer goods, is a function of the number of people living or residing in proximity of the site chosen for the sale. The choice of the location of a factory however, depends on the availability of skilled labour and raw materials, on the efficiency of transport facilities, on the fiscal and administrative policy.

Table 1.3 Determinants of demand for real estate

			Determinants	
		Fields	Demand for purchase	Demand for rental
Demand for property and real estate services	Demand from households	Housing (primary and secondary residence)	Demographic trends, government policy, cost of money, income levels	Change of households, income levels, quality of supply, level of rentals
		Retail trade	Population served, propensity to consume, household incomes	Quality of supply, cost of money, level of rentals
		Hotels	Served population, household income, spending on free time	Quality of supply, cost of money, level of rentals, seasonal flows
	Demand from firms		Economic cycle, government policies, business strategies	Quality of supply, cost of money, level of rentals
		Wholesale trade	Economic cycle, propensity to consume	Quality of supply, cost of money, level of rentals
		Tertiary sector (offices)	Number of employees, business strategies, organization of activities	Quality of supply, cost of money, level of rentals, business strategies, organization of activities
		Industry	Number of employees, expected economic growth, technological innovation, government policies for employment and investment	Quality of supply, cost of money, level of rentals, production cycles of the specific activity, seasonal production

1.2.9 The Sales Market

In the short run, the factors that influence the demand curve are: the price of property, income, consumer preferences, savings, the interest rate, family composition, migration and eventual replacement assets (real estate rent). Even with regard to the housing supply, since owners occupy a considerable part of the existing buildings (which mostly make up the housing supply), the factors that influence it are more or less the same that influence demand. The selection of properties for sale is therefore function of price, income, education and family composition, preferences and the level of rental. A reduction in income, for example, will certainly affect both the demand and supply, weakening, on the one hand, the desire to buy, and reinforcing, on the other, the desire to sell and thus leading to a considerable fall in prices.

The last few decades have shown a mutual and immediate influence of the national economies of most developed countries. It shows a strong correlation between the housing market and macroeconomic variables (income, inflation, interest rates. etc.), and is given by the substantial correspondence of the index prices in their real estate markets. This correlation is easily observable in the graph of Fig. 1.1, but already in 1999 it was highlighted, in a surprising way, in an empirical study conducted by Case et al. (1999) on a set of data recorded over a period of 11 years. Numerous international studies have investigated the mutual influence between some macroeconomic variables and the housing market in advanced economies. They have become more frequent since it was understood that the real estate market is able to anticipate economic trend.[20] Therefore, its analysis is useful to define optimal economic policies and/or monetary policy (Sutton 2002; Goodhart and Hofmann 2008; Beltratti and Morana 2010).

However some research has pointed out (Iacoviello 2002) that the change in housing prices, found some common correlations in the economies of the countries under observation, other correlations vary in direction and size from country to country. The most significant differences are in the price dynamics induced by shocks to interest rates. These differences are justified by differences in the particular character of the real estate markets of individual nations. Lower transaction costs, a higher Loan-To-Value ratio, a higher frequency of variable-rate loans and higher rates of ownership of real estate, involve a greater sensitivity of housing prices to the interest rate (in the case the United Kingdom).[21] Manganelli et al. (2014b) specifically investigated the housing market in Italy and highlighted the specificities of our market, compared to that of the USA. They point out the strong direct link between inflation and housing prices in Italy, and justify it with the important role attributed, by the Italians, to real estate investment as a protection against inflation. As real estate investment in Italy is perceived as an alternative to bond investments and/or government bonds (i.e. low-risk investments), the increased uncertainty about future returns expected from them during periods of persistent high inflation, directs the savings to the real estate property.

[20] Gjerstad and Smith (2010) say In the recession that hit the world economy in the last century, the expenditure for the purchase of new housing tends to decrease prior to a general economic crisis and the percentage decrease in property expenditure is much greater than that for other components of aggregate output. This pattern is found in the case of ten out of eleven recessions, including the Great Depression of '29.

[21] Tsatsaronis and Zhu (2004) broadly support this thesis, highlight the fundamental role in the dynamics of real estate prices exerted by the "cost of mortgage credit and the conditions under which it is made available", thereby specifying that property values are more sensitive to changes in short-term rates. On the relationship between financial credit and real estate market volatility, see also Nguyen (2013), Anundsena and Jansenb (2013). This study shows that there is a two-way relationship in the long term between credit market and real estate market. The increase in house prices lead to an expansion of credit, which in turn puts upward pressure on prices. Interest rates affect house prices indirectly through the credit channel.

Less likely, is the hypothesis that Italian investors have an "intelligent" attitude, so they buy property during periods of high inflation and high nominal interest rates, borrowing money in times when the real interest rate is so low.

The illusionary households do not realize that these nominal rates are high only because the expected inflation is high and they erroneously perceive a higher real rate. Conversely, in periods of low inflation—such as those at the beginning of the new millennium—there is a return to real estate investments erroneously hoping to access loans at a low real interest rate (Piazzesi and Schneider 2007).

The mentioned study also indicates, in the comparison between Italy and the U.S., the attitude of the investor in residential property that is completely different. There is, in fact an inverse relationship between inflation and property values, as well as an inverse relationship between property values and stock prices.

This confirms that in Italy investing in real estate is considered a relatively safe investment alternative to government bonds. In other countries, such as the United States, property is, instead, considered an alternative to stock investment,[22] of course, characterized by a high-risk profile.

This difference accounts for the fact that in Italy, unlike in the United States, stock prices are a leading variable in property prices, in other words they are able to anticipate the trend of the real estate cycle. The Italian specificity is justified by the considerable weight, which is the equity investment in the financial wealth of Italian households.

Precisely because of an increased financial wealth of Italian families, the increase in stock values, perceived as a substantial increase of this wealth, affects the housing demand that results from a choice of portfolio diversification.

> The ease with which it is possible to transform house price gains into funds for spending differs across euro area economies, partly reflecting institutional differences in mortgage markets. Thus the strength of the transmission of house price shocks to the economy depends on—among other things—the percentage of the population owning a dwelling, the typical loan-to-value ratio (LTV) and possibilities for early repayment of mortgages (ECB Bulletin January 2009).

In international comparisons in recent years (until 2010), it should be mentioned that the net wealth of Italian families (the sum of real and financial assets excluding liabilities) showed a substantial growth rate (comparable to that of France), bringing the ratio of net wealth to disposable income at a level similar to that of the United Kingdom and Japan but higher than Germany, Canada and the United States (Table 1.4). This trend is to be related mainly to the strong growth of real assets (Fig. 1.7).

[22] Between the two markets, however, there is a profound difference. While the stock market is slightly sensitive to inflation, the real estate market instead undergoes a huge influence from the inflationary trend. The investor who operates the stock market looks to equities as representing real capital—therefore their value in real terms is not affected by the change in inflation—the American investor who usually operates on the real estate market, instead, does so with little awareness, that is, he makes choices about the debt in relation to a nominal interest rate rather than to real rates.

The increase in net wealth was equal to 102 % between 1995 and 2009. The absolute increase was equal to 4.347 billion euro from a composition of increments of 3.113 billion euro for real assets, 1.839 billion euro for financial assets and 605 billion in financial liabilities. In examining the composition of the wealth of the families that results from the real assets, it appears that the weight in the value of housing has increased from 78.6 % in 1995 to 82.1 % in 2009. The role of home ownership is therefore essential to define the level and growth of the richness of real assets and, given the weight of the latter, to determine the level and increase in the net wealth of Italian families.[23]

With regards to the relationship between income and house prices, it can be said that a decrease in family income; especially for the less affluent ones, for whom the rigidity of consumer spending significantly erodes the saving rate, has obvious immediate repercussions in the choice of buying a property.

The diagrams of Figs. 1.8 and 1.9 show the relationship between income and property prices. Figure 1.8 shows for the different Italian regions the GDP per capita and the average unit price for residential housing. Regions with lower GDP values of GDP also have lower unit values of homes. In Fig. 1.9, one can see that the unit value is related to disposable income of the family.

Even in this case, the relation of proportionality is evident. For those regions, such as Liguria,[24] Trentino, Tuscany, Lazio and Valle d'Aosta, which have residential housing prices above the normal trend line, the justification for this apparent "abnormality" can be attributed to the demand that comes from abroad for reasons essentially related to tourism. The figure for Campania is not in line with the general trend probably for different reasons: (1) the high urban density of the metropolitan area of Naples where the majority of the population is concentrated, (2) a misleading measure of GDP that does not take into account the shadow economy.

Both quantitative and qualitative characteristics of the demand for real estate in particular depend on income. If it is true that expenses for houses vary in proportion to changes in income, then statistical surveys can show that families tend to increase their spending (relative to housing) in a manner that is proportional to income growth. In practice, the increase in income corresponds to a decrease in demand for properties of a lower value, while the demand for properties at an average price range remains stable and properties of higher quality and price range, increase. The constructors, who are well aware of this phenomenon, increase the production of top quality properties (and hold back the supply of cheaper types) when the area of the submarket is in the process of economic expansion.

---

[23] Jappelli et al. (2001) show that while in 1990, bank deposits and government bonds amounted to two-thirds of the families' financial wealth, in 2001 they represented less than a third. "The void was filled by the increase of investments primarily in equities, mutual funds and other forms of asset management. The growing diversity of family assets towards forms of equity investment was induced by the decrease in the return of government bonds, reform measures, the wave of privatizations of public companies and the phase of strong growth in share prices".

[24] In this case, the particular morphology that greatly reduces the supply of building land contributes to the "abnormality" of the data.

Table 1.4 Net wealth of families in relation to disposable income ratio

Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
USA	6.27	5.84	5.57	5.16	5.64	6.03	6.47	6.58	6.25	4.76	5.11	5.26
Canada	5.07	5.02	5.03	5.13	5.16	5.18	5.34	5.46	5.48	5.39	5.51	5.46
Japan	7.42	7.4	7.79	7.78	7.87	7.8	8.06	8.13	8.09	7.77	7.79	7.76
Germany	5.42	5.45	5.42	5.42	5.55	5.67	5.87	6.00	6.29	6.17	–	–
France	5.54	5.65	5.6	5.76	6.27	6.83	7.52	7.96	8.09	7.6	7.6	8.12
UK	7.69	7.68	7.14	7.16	7.49	7.99	8.3	8.7	9.00	7.56	8.03	8.23
Italy	5.95	6.02	6.45	6.85	6.94	7.14	6.96	7.11	7.29	7.52	7.79	7.95

Sources for Italy Bank of Italy and Istat (National Institute of Statistics); for the remaining countries: OCSE drawn from the Bank of Italy (2012)

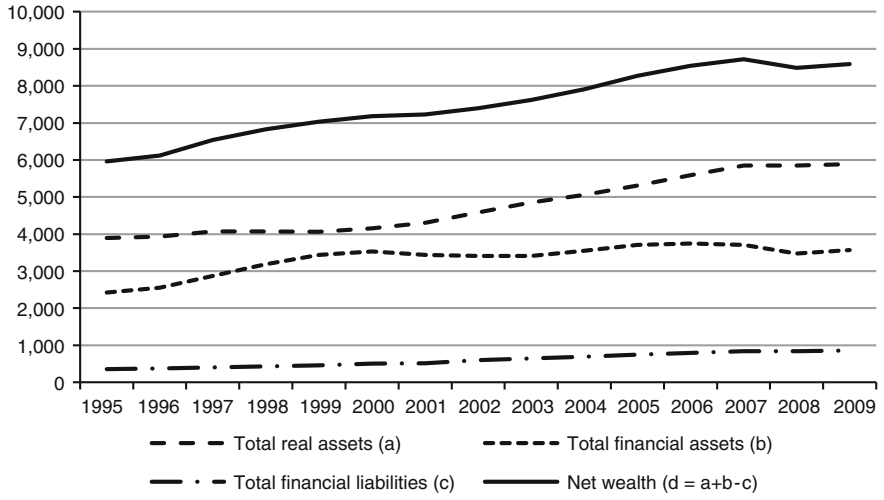


Fig. 1.7 Wealth of Italian families in millions of euro—prices 2009 (*Source* Bank of Italy 2010)

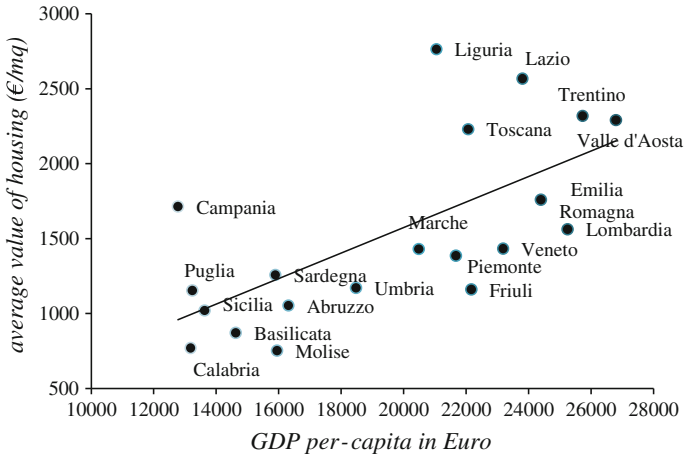


Fig. 1.8 Relationship between GDP per capita and real estate prices in the Italian regions

In theory, therefore, the property prices of lower quality houses tend to move in the opposite direction to the cycle, while the prices of properties of the upper classes follow the economic trend.

Another possible interpretation of the direct link between income and house prices is provided by Beltratti and Morana (2010), who deduce that a negative shock to the first variable leads to a reduction of real estate returns (rentals) and at the same time to an increase in the capitalization rates due to the resulting inflation and growth in interest rates (Otrok and Terrones 2005; Goodhart and Hofmann 2008;

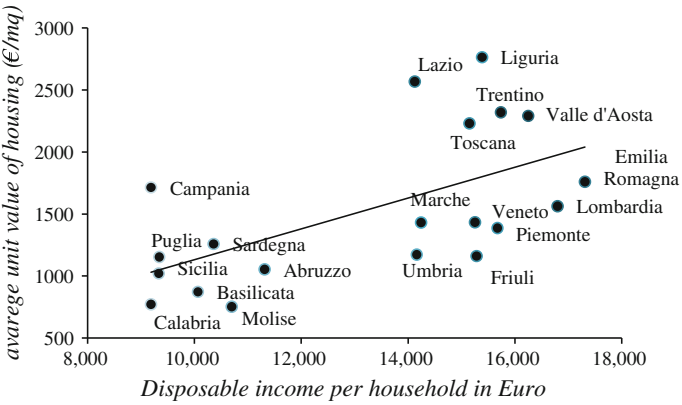


Fig. 1.9 Relationship between family disposable income and real estate prices in the Italian regions

Jarocinski and Smets 2008; Conner and Youguo 2004). This consideration highlights the direct link between the sales market and the rental market (which is better analysed in the next section).

1.2.10 The Rental Market

The rental market, which has as its object the use of the property, is diversified from the sales market. Investors buy properties in relation to the ability of these assets to generate a flow of benefits. The most important portion of these is derived from net operating income that they get from the tenants.

The study of the behavioural characteristics of the two submarkets obliges us to make a distinction among the owners. It is in fact different to the behaviour of those who take advantage of real estate with the primary purpose being a large scale investment activity, compared to those who do not consider property as an economic activity, which is done on a small scale; for example a family purchasing a property.

In the latter case, the activity may be terminated when new needs intervene (the leased property is necessary to the family for use on their own). Although in legal terms an investment activity of the first type cannot give rise to a real business, and thus it may happen that real estate assets of considerable consistency are administered on a family basis, in economic terms the division is necessary because:

1. As mentioned, the rental market behaviour of the small proprietor is different to that of the administrator of large real estate portfolios, especially in the setting of rentals and the choice of the filling rate of the units available;
2. The individual properties show considerable mobility between the sales market and rental market.

In analysing the trend of the rental market, the supply from companies that offer property on an ongoing basis and for which it is their main economic activity, is used as a reference model. The behaviour of those who have been defined individual owners will be analysed then merely as a corollary of the main analysis on businesses. Businesses operate on the market with the aim of maximizing profit. As regards the market model that can schematize their behaviour, first of all, supply is pulverized: each owner/investor has a very small portion of the total supply. No property is equal to another. Taking this into account and the degree of freedom that the owner has in the determination of the relationship between levels of rentals and vacancy rate, a state of monopolistic competition represents the realty.

The owner is well aware that the costs vary only slightly with the variation of the vacancy rate. The profit therefore depends on the number of units rented and the level of rentals. In these conditions, the economic optimum is achieved with a particular combination of these two variables. It should be noted that the lease is the result of a negotiation on the offer of a service, the duration of which, is the lifetime of the investment, but the payment of which cannot be considered fixed throughout this period. If the rental fee negotiated at the beginning of the service in fact remains unchanged for the duration of the investment, the owner could occupy all units. He could achieve this by progressively reducing the rentals up to the state in which the marginal revenue equals the marginal operating cost. Assuming constant expenditure, that is independent from the amount of rented units, the balance would be achieved by practically nil marginal rentals, namely those offered for the last units still to be rented.

In fact, if the owner tries to occupy the units that are still free by reducing the rentals, such action could finally produce a decrease in the net profit; any reduction of the rental applied to real estate, vacancies still will have to be applied in a reasonable interval even to the units already occupied. The owner cannot keep different rentals for individual tenants for a long time. He will therefore have to combine action on rentals with action on vacancy rate. Once one reaches the equilibrium condition, the ability to increase profits by reducing the vacancy rate can result from an increase in demand. For example, a rise in the demand for production space for rent may be determined by a period of general expansion of economic activity. The increase in demand causes a rightward shift of the curves of the average revenue (demand) and marginal revenue.

The presence of a more or less high vacancy rate implies—unlike what happens in the sales market—that in the short term, the supply in the rental market is characterized by a certain degree of elasticity. This leads to a new state of equilibrium, which corresponds to an increase in the average level of the rentals and a higher occupancy rate of the properties offered.

The rental market thus shows a different trend to that of the market sales, although the two markets are logically interrelated. In the case of housing for example, both markets are contingent on demographic. On one hand, the families of low and middle income are oriented towards renting after careful evaluation of the available supply and the level of rentals. On the other hand, families with a greater economic opportunity choose to purchase and consider the convenience of

the use of financial instruments and possible regulatory incentives that can encourage the purchase of the property.

Particular real estate dynamics are able to anticipate similar economic situations. Many economists believe that the housing bubble is at the origin of the economic crisis of 2008. The approach normally used by economists to determine any speculative real estate bubble is based "on the pricing of assets" in practice on the relationship between housing prices and the cost of housing services (the rentals[25]). A ratio prices/rentals significantly above its historical average is a sign of an overestimation of house prices.

The empirical evidence in fact showed that in the last phase of strong growth in real estate prices (2000–2005) the ratio prices to rentals (index of nominal prices divided by the component relating to the rent of the house price index consumption) reached all-time highs in the countries (Ireland and Spain) where the effects of the bubble were most evident.

This approach is based on the concept that rentals are a proxy for the dividend correspondent to the purchase of a property namely the dividend of the non-financial real estate investment business.[26] In this perspective, an expected increase in future dividends, with the same boundary conditions, leads to an increase in the value of the underlying asset. Namely, high rents should grow the demand for housing for their own use, and most significantly the demand for investment, thus causing the increase of purchase prices. Opposite mechanisms should instead be generated when low returns in the housing market—compared to higher returns on alternative investments, which in turn may be reflected in mortgage rates—result in an increase in the demand for rent by individuals who find it more convenient, compared to the indebtedness required when purchasing. On the other hand a possible overestimation of the purchase price of the residential property would lead to lower purchases and increased rental demand, which in turn would drag upward even to the rentals. To further confirm the above statements, it is also stated that if one looks at housing as a consumer good, the purchasing and renting must therefore be regarded as perfectly substitutable economic actions in relation to the need to meet. That said, remember that two substitutive goods or

[25] An alternative to this approach is the structural model for the assessment of residential property that combines factors of supply and demand. Examples of application of this model are those already described above.

[26] In order to identify suspicious distortions in the housing market some economists observe and measure changes in the price-to-rents compared to the corresponding changes in the so-called "user cost". The latter reflects the annual cost of a dwelling as a place of production of the "housing service" for the owner. The cost of housing services as an alternative to the lease, it is then considered as a reference indicator of the rental value. Poterba (1984), defines the user cost as the sum of contributions, calculated as a percentage on the price of housing, which reflect respectively: the lack of interest in alternative investments, to the purchase of housing, correct according to eventual benefits arising from the deduction of taxes or by deductibility of interest on mortgages; incidence of taxes on real estate; the depreciation of the cost of construction; the capital gain/loss attributable to the value of the property according to the market trends (the latter with a minus sign).

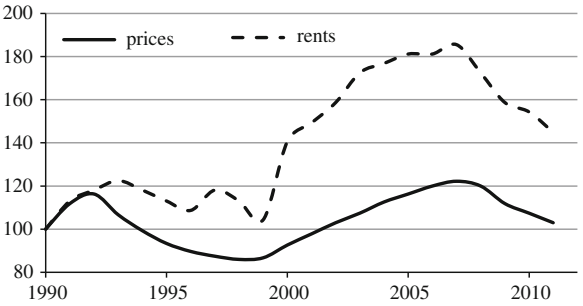


Fig. 1.10 Changes in gross rentals and index prices of residential properties in Italy

services have positive cross-price elasticity of demand: that is, the higher the degree of substitutability between two properties, the greater the decrease in demand for a property, due to the increase of the price of the other. In perfect market conditions, the condition of long-run equilibrium should appear like a mutual effect of dragging up or down of prices and rentals.

An indicator based on the relationship between housing prices and rentals could not reflect a real condition of over-or under evaluation in the real estate market, because different external forces are acting on the two compartments or the same actions can produce different effects on the two markets. The most obvious reasons for caution in using this approach relate to structural limitations, which are related to the current legislation of rentals, the procedures for measuring reference prices, as well as the different liquidity of the sales market compared to the rental market due to high transaction costs and constraint indebtedness. Some studies in literature show that price developments in the two compartments strongly divert (Fig. 1.10) (Manganelli et al. 2014a).

References

Anundsena, A. K., & Jansenb, E. S. (2013). Self-reinforcing effects between housing prices and credit. *Journal of Housing Economics, 22*(3), 192–212.

Bank of Italy. (2010, December). The wealth of Italian households. *Supplements to the Statistical Bulletin*, *67*.

Bank of Italy. (2012, December) The wealth of Italian households. *Supplements to the Statistical Bulletin*, *65*.

Beltratti, A., & Morana, C. (2010). International house prices and macroeconomic fluctuations. *Journal of Banking and Finance, 34*, 533–545.

Case, B., Goetzmann, W., Rouwenhorst, K.G. (1999). *Global real estate markets: Cycles and fundamentals*. Working paper, International Center for Finance, Yale, 99–03.

Conner, P., & Youguo, L. (2004). The complex interaction between real estate cap rates and interest rates. *Briefings in Real Estate Finance, 4*(3), 185–197.

Dandri, G. (1969). *Il Mercato Edilizio*. Milano: Giuffrè.

European Central Bank. (2009). Monthly Bulletin January 2009, p. 64.

Gjerstad, S., & Smith, V. L. (2010). *Gross domestic product and its components in recessions*. Orange: Chapman University.

Coons, B. T., & Glaze A.E. (1963). *Housing market analysis and the growth of home ownership*. Columbus: Ohio State University.

Goodhart, C., Hofmann, B. (2008). *House prices, money, credit and the macroeconomic*. Working paper series, European Central Bank, 888/April.

Iacoviello, M. (2002). *House prices and business cycles in Europe: A VAR analysis*. Working Papers in Economics, Boston College, 540.

Iacoviello, M., Neri, S. (2008). *Housing market spillovers: evidence from an estimated DSGE model*. Paper provided by National Bank of Belgium in its series working paper research, 145.

Jappelli, T., Julliard, C., Pagano, M. (2001). *La diversificazione del portafoglio delle famiglie italiane*, Centro Studi di Economia e Finanza (CSEF) Dipartimento di Scienze Economiche, Università di Salerno (Lavoro preparato per 'L'indagine annuale 2001 sul risparmio e sui risparmiatori in Italia' curata dal Centro Einaudi).

Jarocinski, M., Smets, F. (2008). *House prices and the stance of monetary policy.* Working paper series, European Central Bank, 89.

Keynes, J.M. (1936). *The General Theory of Employment, Interest, and Money*. Cambridge: Macmillan Cambridge University Press.

Lacaze, J.P. (2008). La speculation, bienfaits et mefaits. *Revue Urbanisme*, *362*, 46.

Li, Q., & Chand, S. (2013). House prices and market fundamentals in urban China. *Habitat International, 40*, 148–153.

Lipsey, R. G. (1968). *An introduction to positive economics*. London: Weidenfeld & Nicolson.

Manganelli, B., & Murgante, B. (2012a). Spatial analysis and statistics for zoning of urban areas. *World Academy of Science, Engineering and Technology, 6*(11), 98–102.

Manganelli, B., & Murgante, B. (2012b). Analyzing periurban fringe with rough set. *World Academy of Science, Engineering and Technology, 6*(11), 840–846.

Manganelli, B., Pontrandolfi, P., Azzato, A., & Murgante, B. (2013). Urban residential land value analysis: The case of Potenza. *ICCSA 2013, Part IV, LNCS, 7974*, 304–314.

Manganelli, B., Morano, P., & Tajani, F. (2014a). House prices and rents. The Italian experience. *WSEAS Transactions on Business and Economics, 11*, 219–226.

Manganelli, B., Tajani, F., Nesticò, A. (2014b). Macroeconomic variables and real estate in Italy and in USA, *Italian Journal of Regional Science* (in press).

Nguyen, Q. H. (2013). Housing investment: What makes it so volatile? Theory and evidence from OECD countries. *Journal of Housing Economics, 22*(3), 163–178.

Nneji, O., Brooks, C., & Ward, C. W. R. (2013). House price dynamics and their reaction to macroecomonic changes. *Economic Modeling, 32*, 172–178.

Otrok, C., Terrones, M.E. (2005). House prices, interest rates and macroeconomic fluctuations: International evidence, International Monetary Fund, mimeo.

Paciorek, A. (2013). Supply constraints and housing market dynamics. *Journal of Urban Economics, 77*, 11–26.

Piazzesi, M., Schneider, M. (2007). *Inflation illusion, credit, and asset pricing*. Working paper series, National Bureau of Economic Research, 12957.

Poterba, J. (1984, November). Tax subsidies to owner-occupied housing: An asset market approach. *Quarterly Journal of Economics*, 729–752.

Shiller, R.J. (2007). *Understanding recent trends in house prices and home ownership.* Working paper series, National Bureau of Economic Research, 13553.

Sutton, G.D. (2002, September). Explaining changes in house prices. *BIS Quarterly Review*, pp. 46–55.

Triffin, R. (1947). *Monopolistic competition and general equilibrium theory*. Cambridge: Harvard University Press.

Tsatsaronis, K., Zhu, H. (2004, March). What drives housing price dynamics: Cross-country evidence, *BIS Quarterly Review*, 65–78.

Chapter 2
The Market Research

Abstract The success of a good investment is based on an adequate market research. The peculiarities of the real estate market and, in particular, the large possibility of differentiation of investment properties, compel to increase efforts in the research market, surely greater than those required in other sectors of the economy. An investment decision is supported by the acquisition, organization and analysis of information that may relate to the general aspects of the real estate market, the particular aspects of the property on which one plans to invest and finally the characteristics of the investor. The chapter lays out the key stages of market research, and identifies the essential parameters, such as the results of market research, on which the final decision is based.

2.1 The Usefulness of Research

The investment in property reflects the confidence that one has in the ability of a property to generate profits. The revenue from the management and eventual resale of the property (capital gains) represents the returns obtained by investors in this sector. They are future receipts whose magnitude depends on a number of circumstances. For this reason, the success of investment decisions is essentially the result of an assessment based not only on accurate knowledge of the characteristics of the property, but also on the analysis of reliable and adequate market research. The main objective of these investigations is to predict the potential demand and the supply's conditions today and tomorrow. The output of market research, first of all, will have to provide useful information for locating and defining architectural building products, and then the basic elements for the calculation of return on investment.

Entrepreneurs are not the only ones to commission studies on the housing market: even banking institutions interested in assessing the risk of interventions that they fund, or the Public Administrations in order to provide the guidelines for the development of cities and the amount of services and necessary infrastructure,

B. Manganelli, *Real Estate Investing*, DOI 10.1007/978-3-319-06397-3_2

can promote market surveys in real estate. Obviously, the difference in objectives between the various operators determines the characteristics of the commissioned studies.

The owner of a construction company that is buying a building plot will be interested in studies of the local market in order to pin-point destinations and types of construction. Unlike an investor interested in building a major shopping center, who will commission studies of supra regional level to provide information about the location of the project.

Investors need information both in the ex-ante phase—the phase that leads to the initial decision about the appropriateness of the investment—and in progress when it was necessary to correct their choices in relation to changing and unexpected scenarios. The research in progress is therefore instrumental in the adoption of alternative solutions that modify the initial estimates of the cash flows, but they are also useful in regards to decisions about a more efficient portfolio management (purchase or sale of a property) or administration of a property. The chance to divest, or to readapt some properties by converting them to a different use, involves choices that depend on the same variables that influence the decisions needed to be undertaken for the investment.

In this sense, market research should be directed towards the identification of any changes in income levels, consumption patterns and the employment rate. That is, those variables that could change the need for spaces in quantitative and qualitative terms. The investor must collect all relevant information for the pursuit of maximization of profits. For example, to support decisions about the space available for rent on a long or short-term basis or to suggest choices that take into consideration a larger public of potential users dividing it into multiple units.

Even in the field of design, market research expresses potentially high efficacy: for example, it may affect the constructive choices in such a way as to satisfy the desires of the consumer. It is, therefore, essential information for the preferences of current and potential tenants regarding the technological equipment of a building. On the other hand, research could reveal that the provision of some comfort does not generate additional revenue to cover operating expenses and maintenance, while other interventions should be implemented in order to raise the income potential of the building.

As in many sectors of the economy, even the real estate market research is focused on the reasons for purchasing decisions.[1]

The peculiarities of the housing market and in particular the enormous possibilities of differentiation it offers, imply a commitment to research certainly greater than that required in other sectors of the economy.

[1] Since the sociological factors affecting the quantitative and qualitative demand for real estate in an attempt to intercept the wishes and needs of the citizens, the market research integrates technical survey of opinion in it. In this sense, sociological research, technical functionalism, and the methods proper to the opinion polls are treated in numerous studies (Chapman 1975; Hall and Greenman 2013; Chan et al. 2009).

If the housing market were perfectly competitive (i.e. if all its operators were price-takers and the product was standardized), there would not be a need for a thorough investigation of the market, but it would be enough to focus exclusively on cost control. Unfortunately, this is not so. As already said, there are no identical properties, just think of the uniqueness of the location. Other differences are architectural, aesthetic, quality of construction, finishes, etc.

In addition, there are only differences in the perception of potential tenants or buyers, which can be much more important than the actual physical differences. The reputation of a specific real estate property, for example, is the consequence of a series of sensations that determine the definition of an idea as favourable (or unfavourable) in the mind of persons (Kearns et al. 2013). It is a discriminating feature that cannot be duplicated from competition. It is possible, however, to generate, in function of the results of specific research, a reputation that will attract a certain type of customer (a defined target, once again, on the basis of market data, as well as in function of the business strategy).

2.2 The Availability of Data and the Sources

When the reasons for the search are defined correctly, the next step is to collect a sufficient amount of information. This task is hampered by poor availability and low quality of the information provided. In fact, in Italy the development of market research related to the construction industry is lagging behind the majority of other sectors that produce durable consumer goods. On the other hand, in recent years—and in the wake of what is happening in other countries—a new trend seems to have arisen: a greater role is being given to the financial analysis of real estate investments. Today, many institutions are providing for the creation of comprehensive and detailed databases.

Generally speaking, in relation to the sources from which it comes or from the way in which it is collected, the information is divided into primary and secondary. Primary information normally derives from direct sources and it is detected by the analyst as a function of a particular type of investigation; secondary information derives from indirect sources and therefore collected previously and for different purposes compared to the task assigned to the analyst. Obviously, the first involves a greater expenditure of resources.

The main shortcomings of secondary information are related to:

- The form in which they are made available—usually not consistent with that required by the analyst;
- The fact that they are often outdated.

Sometimes these problems can be overcome through an update and reset of data. It is therefore necessary to replace or supplement the secondary with the primary ones. The latter type of information is obtainable via a direct survey carried out through observations or interviews. The choice of research method

depends on the nature of the information that is relevant to the analyst: observing means identifying and recording relevant facts and trends. The facts in the housing market are nothing more than the prices. They represent real and objective data. The perfect measures of economic size (the value) relating to goods obviously different from the one to be evaluated; the prices are the only basis of the estimate. When prices are not available or search for these lead times and high costs, it is possible to acquire information about the willingness to pay through interviews. In this way, the market is simulated. However, the technique of direct observation of prices is much more reliable than the corresponding information derived from interviews. The latter may be distorted by more or less strategic behaviour of respondents, also taking into account the normal inclination to answer what one believes the interviewer wants to hear. Answers may also be affected by how the question is structured and sometimes by the same interviewer. On the other hand, the interview technique is less expensive but also more versatile: to obtain the desired information, it is sufficient to carry out a survey and it is not necessary to wait for occurring the phenomena that one wants to observe.

It should also be pointed out that prices do not exhaust the request for information necessary for an accurate analysis of real estate investment (Table 2.1). Much of the market survey must focus on elements provided in descriptive form. For example, this is true for data regarding the profile of the typical tenant (based on the information obtained by the tenants of similar properties), the profile of the typical resident/consumer or the renters' reactions to hypothetical changes in terms of the lease, etc.

The indirect sources often make their information available in a raw form, i.e. not immediately usable if not by re-elaboration and integration with data and information from other sources (maybe direct). Among the indirect sources there are both public authorities (Inland Revenue Statistics Institute, the Provincial Administrations, Chambers of Commerce) and private (estate agents, brokers) specializing in market research. Some of these, through the collection of information, the construction and development of a database, ensuring the distribution, free or paid, of much information in different formats and classifications.

The volume of statistical data available at national and regional level is remarkable and it is often difficult to navigate and understand how to integrate the different secondary information with the primary ones. In fact, the biggest limitation of indirect sources is to incorporate data relating to small areas in statistical tables of larger areas. If the market analysis is confined to a specific area, there is therefore a risk: given the scarcity of specific information of the area, to accumulate useless data readily available relating to larger geographical contexts.

With regards to the main information for the analysis of the housing market (the price), there are several indirect sources that provide average quotations (note that it is not prices) broken down by type of property and location (urban area).

The use of these sources is thus able to provide an overall picture about the trends and market behaviour in a particular area and with reference to particular segments.

Table 2.1 Useful information for real estate analysts

Population	The surveys carried out periodically provide statistics on the population divided by age, sex, race, and education, size of households, employment and income
Housing conditions	Data on the size of housing, type and condition of facilities, number of people per apartment, average market value, rents, etc
Retail trade	Number of stores of different types, total sales and number of employees
Industry	Number of firms, employees, type of business
Wholesale trade	Volume of transactions, size of warehouses, expenses, employees
Manufacturing	Number of companies, business sector, employment, sales
Transportation	Cars, trains, trucks, buses
Agriculture	Land use, quantity and value of products
Public administrations	General characteristics of public bodies, employees, debt, revenue and expenses

These sources are therefore useful in a preliminary evaluation summary. The reliability of these indices is questionable when one wants to use them in the final assessment of the investment. There are no two identical buildings and no profitability index, as accurate as it may be, that can be considered an adequate measure of what is happening to the value of a particular property at a precise moment. There may be no correlation between the return on commercial real estate, in street X of the urban area Z, and that of similar properties located in the same area; even the value of a newly built residential property could present a trend of values different to that of a similar property, also for location, but a few years older.

The main cause that weakens the reliability of overall indexes (e.g. quotations), then, is the difficulty of incorporating the definition of a given medium, the large number of factors that affect the value of an investment property.

The situation changes, although not by much, with regards to the collection of information about the elements that make up the cost of construction. The problem in this case arises when the enforceability of the investment project still has not been reached. Namely, the estimate of the cost cannot be carried out in an analytical way (with indirect approach) through the development of the bill of quantities of work to be executed. One needs to evaluate the costs with direct processes through the collection of information relating to similar experiences. Even in this case there are direct and indirect sources.

The first are those that provide data and information (primary) immediately useful, effective, coherent and properly organized for practical purposes. Companies operating in the field of production mostly represent these sources and their accounting records constitute information. It is therefore clear that it is not easy access to such information. From this point of view, the better organized companies have a bigger advantage: their estimates are based on direct knowledge of the cost of labour and real productivity, material costs and loss ratios, the use of equipment, overhead costs and any other incidence. Unfortunately, this data is not

made public because of the highly competitive nature of the construction industry and secrecy in this case has a logical justification.

The sources provide indirect information derived statistically from historical data; their use requires a conversion or corrections of various types. The information is probabilistic and it consists of cost parameters published by organizations, public institutions and the press dealing with the economic aspects of building technology. This data is related to the national market, regional or provincial, and is classified by quality and consistency of the work or building type. Of course there is historical data, reported at a time has already elapsed. This nature makes them unsuitable for immediate use. The transfer of this information to the real conditions of a project under consideration thus involves the application of a series of corrections to operate normally using coefficients, which reflect the temporal differentiation: typological and location (Manganelli 2011).

2.3 The Development of the Research

Market research is developed through a series of stages, with different stages being more complex and expensive as the level of detail of the analysis increases. Starting from the information that is easier to find, the investigation can proceed with the collection of data that are more detailed and financial analysis more and more elaborate. An investment decision is supported by the finding, organization and analysis of information that may relate to the general aspects of the real estate market, the characteristics of the property and, finally, the characteristics of the investor.[2]

The basic rule for a correct market research requires, before starting to collect data, the careful framing of the problem one wants to solve and the precise definition of the goal one wants to achieve. This will determine the type and amount of information that is necessary.

The information to be collected has already been emphasized; it is related to the variables that determine the demand and to those that may have an impact on supply. For example, the information on demography (population, employment, family composition and purchasing power), on economic and fiscal policies which have an impact on real estate investments (news about incentives to companies that set up in the area, or relating to territorial agreements on agreed rents, etc.).

Market research is instrumental to the identification of models of possible future development of the property market in the area. To this end, one can also refer to the general economic forecasts drawn up by local authorities and Chambers of Commerce. The results of these studies are usually available for free or at a modest cost. Thus, it facilitates the collection of data referred to the past and

[2] Vincent and Blair (1988) have defined the market research as the most difficult and essential part of the entire process of estate planning.

current conditions of metropolitan or regional market, and referred to the demographic and socio-economic status of potential end-users (tenants or buyers). From this information, one can extrapolate estimates of the likely socio-economic future. However, note that the purpose of the analysis is to estimate the future conditions with reference to a specific property, which is influenced in a limited way by trends in a wide market area.

Moving from the general level of analysis to those progressively more detailed, there is obviously less available information. However, the analyst, working on the relationship between local indexes available and economic projections—national, regional or metropolitan—will produce estimates of the market area and the market segment in which the property, object of interest, is located.

Knowledge of the economic mechanisms that regulate the real estate market on a broad scale (national, regional or provincial) is therefore a starting element for the investigation of the local housing submarket, with reference to what is necessary to define relationships, current and projected (over of the investment period), between supply and demand. The specific property is, in fact, subject to a competition, which in most cases comes from a very small size sub-market. For example, a number of shops located along a city street are not in direct competition with a hypermarket able to attract customers even from areas outside the region, and a small office building placed in the suburbs (will be affected only marginally) cannot be competitive with a property same destination, but larger in size, located in the city centre. The boundaries of the submarkets are fixed by the way tenants, investors and users perceive the differences in localization, in rents, in size of property, in age, in condition and functionality of buildings, and in all those characteristics that make a property more or less desirable than other, more or less replaceable with other.

It is necessary, therefore, to make use of techniques that allow to switch from the available data related to regional or metropolitan scale of the real estate market to a forecast of the submarket of which is part the specific property.

Myers and Beck (1994) have described one of the possible strategies that generate a forecast on the performance of variables that influence supply and demand of the specific property. It is divided into the steps described below and shown in Table 2.2.

I. *General data collection*

Public and private research institutions periodically develop aggregate estimates of parameters such as the rate of employment, income, rate of growth and the demographic composition of regions, provinces, municipalities, etc. This information forms the nucleus of the forecast on the future of macro-market (in the upper right quadrant).

II. *Specific data collection*

One proceeds to the collection of information relating to the physical and economic characteristics of the particular market segment to which the property belongs (bottom left quadrant). The data should be organized so one can quickly

Table 2.2 Scheme for the construction of specific indices starting from general ones

	Actuality	Future
Metropolitan or regional market	III	I/IV
	Current and past	Forecast
	Economic and demographic data	Economic and demographic data
	Vacancy rate, rents	Vacancy rate, rents
Specific property and its sub-market	II	V
	Physical characteristics	Property
	Demand characteristics	Performance
	Rent and vacancy rates	Forecast
	Estimation of market share purchasable	

relate to studies predictive on changes in the macro-market. The vacancy rate and the trend of rents, for example, are related to construction activities and demographic changes.

III. *Analysis of the relationship between general and specific data*

One needs to connect the information previously obtained to those similar relating to the metropolitan area and the region (upper left quadrant). With reference, for example, to the vacancy rate and the level of rents one should identify the relationships between the measured variations at regional and national levels, with those that characterize the real estate segment investigated.

IV. *Projection of the general indexes*

One makes predictions about the most relevant regional and metropolitan variables (upper right quadrant), based on the observed relationships that exist between them and other variables in the macro-level (such as the construction activity, and economic developments and demographic) of which the estimates are available.

V. *Projection of specific indices*

Through the comparison of past trends of variables in the right upper quadrant and similar variables related to the real estate segment investigated, correlations that will define the future trend of the specific parameters of the property (in the lower right quadrant) should be identified.

The most effective search method consists in proceeding from the general level to the specific level, according to the following order:

1. Analysis of national economic trends (inflation, interest rates and economic growth) that can, as shown in the preceding paragraphs, to some extent affect the corresponding trend in real estate values;

Table 2.3 Outline of a final report of the results of market research

Summary of the study	Aims of the analysis methods used, data sources, assumptions and conclusions
Overview	Analyses of trends of the most important economic and demographic indices at national, regional and metropolitan level; study of their influence on the local submarket
Submarket and the specific characteristics of the property	Defining the boundaries of the submarket and summary of data on the properties analysed (its description, the greater or lesser attractiveness of its position with respect to real estate competitors, its construction, its age and its condition)
Demand analysis	Estimate of the total demand, in the specific submarket, for properties analysed (forecasts on parameters such as, for example, the general absorption rate)
Supply analysis	Estimate of the building, which is in competition with the properties analysed, analysis of past trends, current conditions and possible future changes. Supply forecast future
Study of the competition	Comparison of the characteristics of the analysed properties and those of competing properties (including those under construction or design)
Estimated future revenue	Prediction of future changes in rents and preferences of potential tenants. Estimation of the vacancy rate and gross revenues during the forecast period. Estimate, in the case of new construction, the specific absorption rate

2. Analysis of economic, demographic and regulatory frameworks of the metropolitan area that have relevance in the local demand for real estate;
3. Definition of the geographical boundaries of the market area (usually the district) in which the property is subject to competition with similar properties;
4. Analysis and demand forecasting (rent and/or potential sale), within the market for the type of property under consideration;
5. Identification and study of competition in the specific submarket;
6. Estimate of the potential supply of new housing units coming from similar competitors during the forecast period;
7. Comparison between the characteristics of the current and future competing properties and the needs of potential tenants (to estimate the part of the total demand of the particular sub-market that will target the property in question).

The results of market research and related analysis should be organized in a final report. The information may be displayed according to the scheme in Table 2.3.

2.4 Reliability of the Research

Three basic factors can affect the effectiveness of market research:

- The stability of market conditions;
- The complexity of the specific property;
- The risk attitude of the investor.

If the market is stable and the property has a few peculiarities, research and highly sophisticated market surveys are not necessary. The right balance between spending time and money to refine the analysis and containment of these costs from which a higher degree of uncertainty would result, depends on the attitude to risk of the investor.

In a market where supply and demand are in stable equilibrium, it would only be necessary for a few studies (level of rents and vacancy rates) and simple analysis (the relationship between net operating income and market value). When circumstances indicate that the changes in the factors will proceed in a linear way and thus in a predictable direction, the development of more refined analysis would be unnecessary and costly.

In all situations characterized by abrupt and extended changes in prevailing market conditions (new policy guidance, migratory movements, increase in construction activity), one will need to collect information and data in quantity and quality sufficient to make predictions about the impact of these changes on the local real estate market. For example, if one works in a neighbourhood that is changing mainly from residential to commercial, it is necessary to analyse the speed of change and its likely impact on future profitability of the properties of interest. One will have to identify the most appropriate management system and the possibility of success during the transition period.

Similarly, further research will have to satisfy a greater or lesser complexity of the investment.

For a small property, such as an apartment building, the need for market analysis is minimal. To get an idea of its potential, it would be sufficient to study its operational history. However, to estimate its value at the end of the investment period one will just have to analyse the relationships between operating income and market values.

If, on the contrary, one has to evaluate the purchase of a property of considerable size adaptable to different uses of nature and profitability, one has recourse to market studies and analyses that are more extensive.

2.5 Costs and Benefits of Research

The deepening of the preliminary analysis is in close and inverse relationship with the uncertainty associated with the decisions. Of course, extensive investigation involves an additional expense for the investor who, according to its attitude to

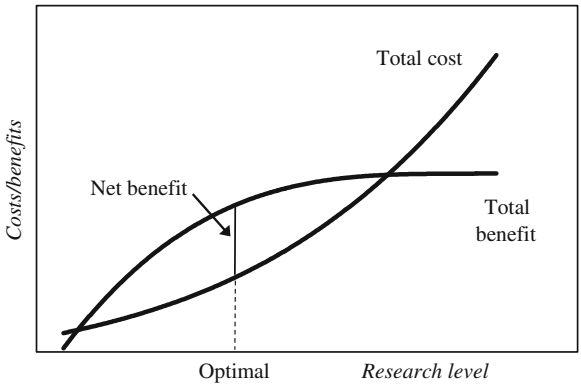


Fig. 2.1 Costs, benefits and optimal level of research

risk, may decide to give up a greater knowledge. Those who, on the contrary, cannot tolerate excessive risks, commit more resources in research reducing the possible profit margins.

The interaction between the extra costs associated with the research and the benefits that are obtained by collecting a greater number of information, is illustrated in a qualitative way, in Fig. 2.1.

Obviously, the optimal choice would be that corresponding to the maximum distance between the achievable benefits and costs associated with these. It is not convenient to push research beyond this optimal point, because, beyond this limit, the higher costs of analysis (marginal costs) would be greater than the gains measured on the benefits (marginal benefits), thus reducing the net benefit. Of course, one cannot have an objective measure of the benefit obtained from the research and the optimal level remains a purely theoretical.

2.6 Defining the Market

A solid understanding of the economic conditions of the area where one is going to invest is a prerequisite for getting to determine the market potential of the project to be developed.

The first step is to define the geographical limits of the area studied (a small community, a city, a metropolis, etc.). In fact, the size of this area is dictated by the objectives of the analysis. If the analysis aims to investigate, the feasibility of a small building for residential use it is sufficient to limit the study to the neighbourhood. However, if the purpose is to establish the location of a large shopping centre, then the analysis will take place on a regional scale.

The market area for a specific property corresponds to the geographical area from which its potential users are attracted. The boundaries of this area can be determined only approximately. Firstly, the factors with the greatest influence in defining the size of the market are costs and time of transfer. With regards to the

residential market the destination of this transfer may be the place of work, the centre of commercial activities, services etc. Whereas with regards to the commercial construction market the goal is the same as that of commercial property.

In equal conditions, sites characterized by lower transfer costs are more attractive.

In the case of the residential market some users, for example, prefer to choose to settle in areas further away from their usual destinations, but that guarantee a better quality of life. That is, the choice is influenced by considerations about the health of the environment, the aesthetics of the neighbourhood, its security, and prestige of its inhabitants. The market area on a residential property can be defined, as already mentioned, as the area within which all units are linked by a chain of substitution. In this area, potential users consider similar housing for the intrinsic and extrinsic characteristics as mutually replaceable.

The market area related to a building intended for commercial activities is, instead, defined by the geographical area from which the majority of customers come from. Even in this case, the ability to attract customers is inversely proportional to the time and therefore the cost of transfer.

There are several techniques to establish the boundaries of commercial market areas; but almost all are fundamentally based on the time to reach the property being analysed.

Some rules of thumb which can steer through the delimitation of the market and indicate the times for the transfer related to different types of business activities, are:

- Supermarket district: 5–10 min;
- Hypermarkets: 10–15 min;
- Large shopping malls: 15–30 min.

The transfer time is instead a useful indicator for the delimitation of the market when the survey covers buildings used to house offices. In this case, the size of the area is influenced by the size and nature of the activity. The larger buildings, or those intended to attract users specialize in particular sectors may compete with similar properties that are located on an entire metropolitan area.

2.7 Analysis of Market Potential

Despite the study is articulated to meet the needs of the specific investment, there are basic steps that are common to all the investigations. The analysis, regardless of its purpose, should always include (going from the general to the particular) the study of the economic situation of the country and the relationships between the national and the local real estate industry. The influence of national factors (government policy, GDP, cost of money, demography, employment, etc.) on submarkets of geographical areas has already been emphasized. Nevertheless, the identification of reliable correlations between the two levels, the macroeconomic

and local, is quite complicated and usually the changes in the economy of a country are reflected (with some delay) in the demand and supply of goods and real estate services differently localized.

Many real estate investments take place after a quick examination of the physical characteristics of the property and a summary study of its potential return. Instead, more complex operations require careful examination of the property (land or a building), the study of the submarket in which the project is located and a financial analysis of the quantity and quality of future income flows.

Each property expresses a potential income that is a function:

- The interaction of supply and demand in the market, which sets the level of rents and the amount of space that can be occupied;
- Its desirability in relation to the competitive scene.

Therefore a series of data that allows one to develop a cognitive framework of the characteristics of the market area should be accumulated, and if properly interpreted, are able to lead the analyst to formulate a prediction about the possibility and the size of future changes in the preferences of the specific market. Essential to the analysis is the information that relates to the population, the level of employment, income levels and planning regulations. A synthetic representation of how important such information is evident in the Figs. 2.2, 2.3, 2.4 and 2.5 that show the relationship between 'price per square meter to buy apartment in city centre' and 'average monthly disposable salary' (income) for the year 2013 (source: www.numbeo.com).

The serial data on the number and types of businesses, their volume of business, can give an idea about the economic and social development of a community. The economic growth that follows siting of new activities results in increases in population, income and consequently induces changes in the use of soils.

For smaller cities, the prospects for growth are strongly correlated to the portion of their export-oriented economy. Companies that offer goods and services, directly or indirectly, in the external markets are decisive for the future economic growth of the settlement. Around these companies, an allied industry is born with new economic activities, thus generating new jobs and an increase in income.

It is also useful to point out how the current occupation is distributed. If in an area the labour force is concentrated in a few industries, the analysis should take into account a potential instability of the economic base. Greater diversification of business activities warrants, instead, increased stability.

One should then complete the cognitive framework by gathering information that takes into account the liveliness and dynamism of the real estate market. One of these is, for example, the volume of loans, which in turn directly connects back, like many other economic activities, to the interest rate applied for funding (Fig. 2.6). The level of rents and occupancy rate of existing buildings represent other critical data to the study of the market area. Thus, if a low level of fees is indicative of a high supply of spaces and limited demand, on the other hand, a high employment rate may suggest an imminent rental growth.

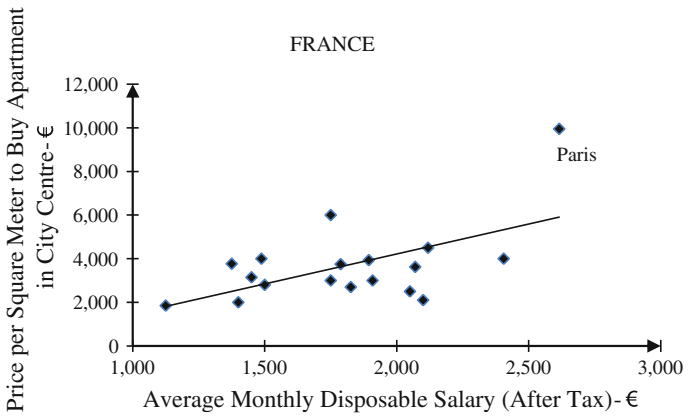


Fig. 2.2 Relationship between 'price per square meter to buy apartment in centre' and 'average monthly disposable salary' in major cities in France

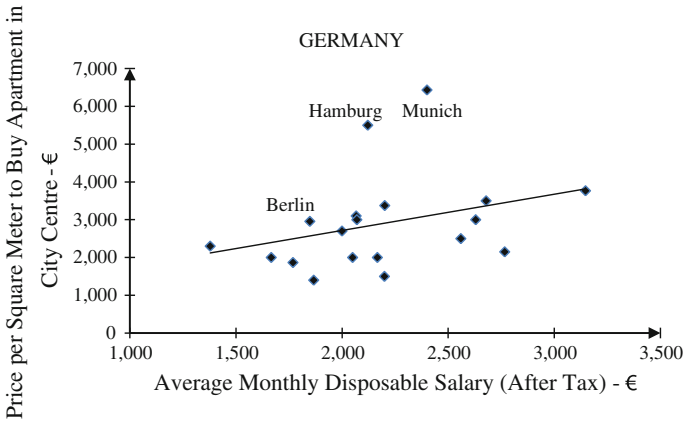


Fig. 2.3 Relationship between 'price per square meter to buy apartment in centre' and 'average monthly disposable salary' in major cities in Germany

The investor who wants to start a building project, needs to know the number of potential users, their ability to acquire the property built or, if he is willing to give them for rent, to secure the payment of rents. It is important, in this sense, to know the trend that characterizes the income and the degree of stability of it. The data on employment and the average level of income can be found both at the chambers of commerce and at national statistical institutes. The credit institutions may provide information on the household savings, the latter being an indicator that reflects the risks about the chargeability of income.

Useful information for market participants, which results from a combination of the above parameters, is the index of housing affordability. The issue of

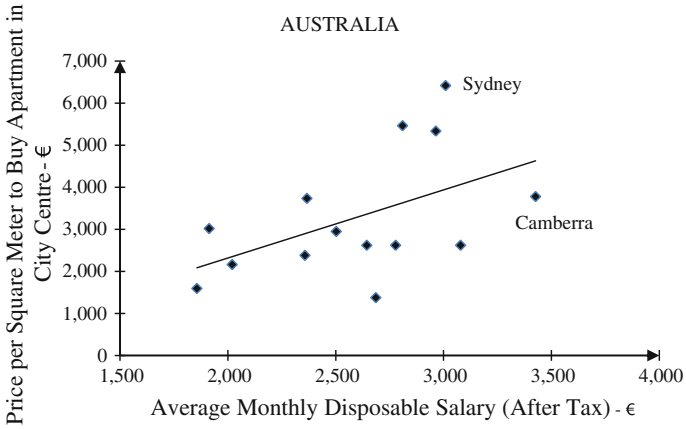


Fig. 2.4 Relationship between 'price per square meter to buy apartment in centre' and 'average monthly disposable salary' in major cities in Australia

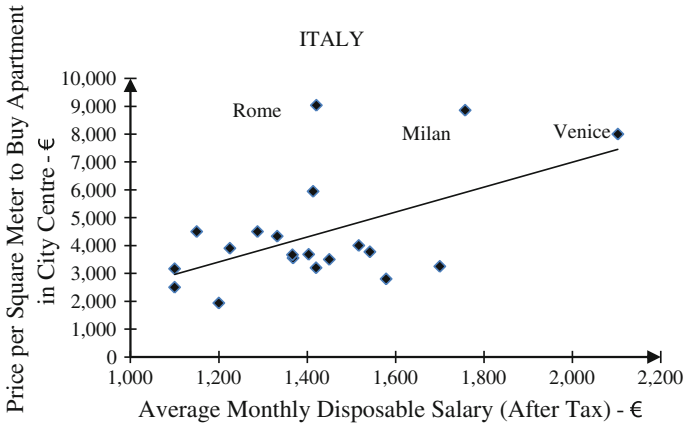


Fig. 2.5 Relationship between 'price per square meter to buy apartment in centre' and 'average monthly disposable salary' in major cities in Italy

accessibility to the housing market has been widely studied with respect to many international markets and the available literature offers several methods of measuring its index.[3] The method of the U.S. National Association of Realtors (NAR) is perhaps the most common and certainly the one based on a very simple concept

[3] Two aspects detect and must be clearly distinguished when looking at this indicator: its level and its variation over time. For a review of the measurement methods of affordability (Ndubueze 2007).

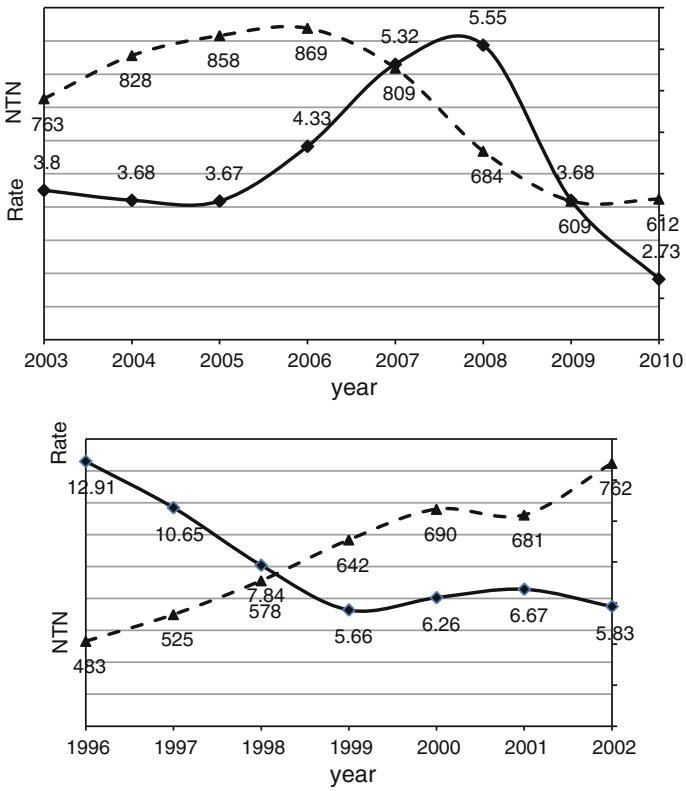


Fig. 2.6 Comparison between the evolution of the volume of transactions in the residential sector and the trend of the average rate mortgage [based on data from the Bank of Italy (The Bank of Italy published, the rate of loans issued to households, as at 2002. However, it has disaggregated data since 2003, and since the data after 2003 is not precise, the same aggregate graph has been divided into two ranges)]

and close to the common reality of families. The method simply involves NAR to calculate the incidence of the mortgage payment with respect to income.

The mortgage payment is a function of the type of amortization, which in turn depends on the interest rate (s), the duration (T) and the percentage of capital borrowed (loan-to-value LTV %). The accessibility of the purchase is verified if the mortgage payment (capital + interest) does not exceed a given percentage of disposable income conventionally identified around 30 % of disposable income. In formula: families are able to buy a home if

$$\text{affordability index} = 30\,\% - \frac{\text{payment mortgage}\ (\text{s}, \text{T}, \text{house price}\ \times \text{LTV}\ \%)}{\text{income}} > 0$$

To plan the number and type of units needed, the investor of residential properties should possess data on the size and composition of families. Marriage and birth indices provide information on family structures. To plan the number and type of units needed, the investor in residential properties must have data on the size and composition of families. Marriage and birth indices provide information on family structures.

Other information to be included in the analysis of the market is related to transportation, infrastructure and connections with various areas of the city. A modification of the preferences on the location, in fact, have as a trigger factor the wiring change and the consequent changes in transport costs.

Transport costs are altered significantly by the interventions on infrastructure networks. Some examples include the construction of a bridge or a new highway, the closure of a railroad station, a change in the availability of parking areas. These changes, speaking on accessibility to certain sites, have an immediate impact on property values. On the other hand, it is obvious that the cost of transport must be understood in an 'economic' sense. For this purpose, the financial cost must be added to the cost attributable to time. Therefore, the user may prefer to live in a building in the suburb (on inexpensive ground) but close to a highway interchange that allows him to reach the workplace quickly, rather than in a busy city centre.

The desirability of a site may also be subject to change due to the social and economic status of the neighbourhood in which it falls. Many situations can alter the attractiveness of a neighbourhood. Consider, for example, the creation or vice versa the closure/transfer of public offices, shops, leisure facilities, schools, etc.

Moreover, urban planning should not be overlooked—this factor can accelerate the incipient transitions from one destination to another use. It is not superfluous to remind the reader that political decisions on urban development represent one of the strongest determinants of land rent.

Changes in customer preferences may involve, in addition to the location, the quality of real estate. In order to anticipate these trends is useful to put as much attention to the decay of the physical and qualitative characteristics of the property compared to competing properties and the position of the latter.

Changes in customer preferences may involve, in addition to the location, the quality of real estate. In order to anticipate these trends it is useful to put much attention to the decay of the physical and qualitative characteristics of the property compared to competing properties and the position of the latter. This raises the problem of how to evaluate the technical and functional decline of a property and how this is reflected on the value of the property. If the determination of the physical life of the property is not particularly difficult, it is not the same case when dealing with the effective identification of the function, which describes its useful economic life. The problem is to define the obsolescence of functional performance (Manganelli 2011). It is determined by changes that occur in parameters such as construction technology, design, and distribution functions. It is impossible to determine the exact day and the force with which these factors will change the preferences of consumers regarding the quality standards of real estate

properties. Fortunately, the real estate market reacts with a lag to the introduction of this kind of news, and this explains the long useful life of a building properly maintained. The fact is that the rise in demand for quality is a constant. A proper analysis, therefore, cannot fail to consider change in scenarios in the medium term.

The competitive framework is the last factor to be considered, closely linked to the site but just as decisive in the choice of investment. This means one needs to investigate the supply, present and future within the market of goods that can serve as a substitute to the property object of interest. The feasibility of each investment, in fact, is heavily influenced by competition.

The research of comparable properties (similar to destination, structural type, age, size, etc.) can be simplified by classifying the buildings in terms of functional efficiency and durability. Two properties that perform the same functions and that are in the same area may not be in direct competition if their efficiency is significantly different. The functional efficiency is related to the specific use of the property and can only be assessed in that context. For example, the dwellings shall be valued in consideration with the way in which they meet the needs dictated by current lifestyles of families; the design of a commercial warehouse is evaluated in terms of compatibility with the new technologies of transport and storage of goods.

Those properties whose functional obsolescence puts them out of competition should not be included in the competitive framework. This is the case of an old warehouse, whose reduced distance between the columns prevents the use of modern mechanical means of transport. In defining competitive framework, one should also take into account the perspectives of the physical life of the properties considered comparable to the one being analysed. It can always be useful to incorporate into the study considerations about the major or minor maintenance expenses resulting from the management of similar properties but of different ages. An old building that today is excluded from the competitive framework, because it was considered unfit to reach the target audience to whom the investment being analysed is addressed to, tomorrow could undergo major restructuring that would place it in competitive conditions.

The potential future competition should therefore be determined by sensing these categories of properties:

- Undeveloped land whose intended use coincides (or could coincide in the future) with that of the investment object of analysis;
- Buildings near the end of their useful life;
- Property subject to an imminent transformation;
- Property, whose urban destination currently not corresponding to that of the investment in question may vary over the forecast period.

Once one has completed the outline of the market and defined the competitive framework, the analyst must make a prediction about the potential demand over the period of the investment, possibly constructing scenarios. Compared to the general framework of analysis proposed, he will have made the necessary changes to conform it to the particular category of investment.

Thus, an industrial intervention deserves a greater effort in the collection of data relating to, for example, transport, the presence of a particular urbanization, the availability of raw material and labour. In the case of a commercial property, greater attention should be given to traffic patterns, the position of competition, public transport, availability of parking areas and the average income of the population.

References

Chan, E., Yiu, C. Y., Baldwin, A., & Lee, G. (2009). Value of buildings with design features for healthy living: A contingent valuation approach. *Facilities, 27*(5–6), 229–249.

Chapman, D. (1975). *Home and social status*. London: Routledge and Kegan.

Hall, M., & Greenman, E. (2013). Housing and neighborhood quality among undocumented Mexican and Central American immigrants. *Social Science Research, 42*, 1712–1725.

Kearns, A., Kearns, O., & Lawson, L. (2013). Notorious places: Image, reputation, stigma. The role of newspapers in area reputations for social housing estates. *Housing Studies, 28*(4), 579–598.

Manganelli, B. (2011). *II deprezzamento degli immobili urbani*. Milano: Franco Angeli.

Myers, D., & Beck, K. (1994). A four-square design for relating the two essential dimensions of real estate market studies. In J. R. De Lisle & J. Sa-Aadu (Eds.), *Appraisal, market analysis, and public policy in real estate* (pp. 259–288). Boston: Kluwer Academic Publishers.

Ndubueze, O. (2007). *Measuring housing affordability: A composite approach*. Birmingham: Centre for Urban and Regional Studies, University of Birmingham.

Vincent, G., & Blair, J. P. (1988). *How to conduct and analyze real estate market and feasibility studies* (2nd ed.). New York: Van Nostrand Reinhold.

Chapter 3
Financing

Abstract Given the substantial commitment of capital required by a real estate investment, the use of financial instruments is usually necessary. The loan involves a double cost: the first is explicit and corresponds to interest payable to the creditor, while the second is implicit, because it has to compensate for the higher investment risk arising from the use of borrowed capital. This chapter gives the necessary information in order to understand if there is a limit to the amount of financed capital able to define the advantages and disadvantages of the investment.

3.1 General Information on Financial Markets

The purchase of investment goods that require a significant financial commitment, as in the case of real estate, normally involves the use of external financing. In this case, one needs to contact a lender for a loan operation for a part (or the total) of the necessary capital. The investor will therefore have to pay interest on the amount financed. The same promoter, who wants to pursue a building transformation, often needs to borrow to deal with the high cost of production. In economic terms, it is well known that an entrepreneur differs from a capitalist: the former is the person who arranges the factors of production and assumes the technical and economic risks associated with it, while the second provides the first factors, the capital and receives the interest as compensation for the services rendered. In reality, the actual contractor can also be a capitalist (or partial capitalist). The use of financial instruments in the field of real estate is usually inevitable; the question is, whether there is a limit to the amount of capital loan defining the advantages and disadvantages of the investment. The relationship between the capital loan and equity is defined as leverage. The most widespread financing option, mainly used by families who buy homes is a mortgage.

However, the financial market is rich in possibilities for those working in the field of investment property. Companies, for example, if structured in the form of joint stock companies, can finance through the issue of shares. The choice between

B. Manganelli, *Real Estate Investing*, DOI 10.1007/978-3-319-06397-3_3

the different types of financial instruments available is never immediate and depends crucially on the type of investment, as well as the goals of those who provide and those who receive money.

Beyond these considerations, the right financing is an important factor for the success of the investment. One has to carefully consider the convenience of the loan and one has to keep in mind that over-indebtedness has, as one will see below, two fundamental implications:

- The intensification of risks;
- Rising costs.

3.2 The Leverage

A favourable financial leverage, one for which the costs associated with financing are lower than the rate of return on investment, leads to an increase on return on capital directly involved and may result in tax savings. These effects are amplified in transactions with a high degree of financial leverage. However, the advantages associated with this investment are outweighed by the danger of being greatly damaged if the leverage became minimally unfavourable. A high leverage and unfavourable financial leverage can turn an investment of modest success in to a disaster.

Examples 3.1 and 3.2 clarify these aspects.

Example 3.1 From a property, whose market value is €1.5 million the investor expects to gain an annual net operating income of €210,000 corresponding to 14 %. A financial institution is willing to finance up to the amount of 1.2 million euro compared with a repayment schedule that provides the monthly instalments (of €10,797) to be paid for the next 20 years at an annual interest rate of 9 %. The amount to be repaid annually is €129,564 (€10,797 × 12). Table 3.1 represents, in addition to the hypothesis that involves the utilization of the maximum indebtedness, assumptions relating to two other financing alternatives.

Moving on the alternative that does not provide any loan to those using higher funding, due to the annual growth of debt, it also reduces the available cash flow for the investor. Looking at the relative indices, one can observe that an increase in leverage—when the ratio of debt and the annual loan amount is less than the ratio of net operating income and the purchase price, or when the interest rate on the debt is less than the rate of return of the investment—produces an increase in the return on equity.

The leverage allows, therefore, to start investments without having all the necessary funds, to improve the return on capital employed and to take advantage of any tax benefits. Moreover, as seen in Example 3.2, it allows to

Table 3.1 Cash flows for the three alternatives of financing

	No loan	Loan of €1,000,000	Loan of €1,200,000
Net operating income	€210,000	€210,000	€210,000
Annual debt	0	−€107,964	−€129,564
Cash flow	€210,000	€102,036	€80,436
Index			
Annual debt/Loan	–	0.108	0.108
NOI/purchase price	0.140	0.140	0.140
Cash flow/Invested capital	0.140	0.204	0.268

boost the gain obtainable from the sale of a property whose value has increased during the holding period.

Example 3.2 An investor is interested in buying an agricultural land located in an area subject to rapid urban expansion. The price was set at €600,000, but he expects a quick appreciation of the soil in relation to the possible change of use (from agricultural to building). The investor provides that in 5 years the value of the land is likely to double for such change planning. At that point, the property will be sold. During the holding period, the land will be leased to a nearby farm, for a rent just enough to cover the taxes. The cash flows, net of tax, will therefore be null. There is the possibility of obtaining a loan of €450,000 for the purchase of the land. The debt, including accrued interest at an annual rate of 9 % will be paid in one instalment at the end of the fifth year.

The amount to be disbursed at the end of 5 years for the repayment of the loan is €692,381:

$$Loan_{5th} = €450{,}000 \times (1 + 0.09)^5 = €692{,}381$$

In Table 3.2 return rates of capital committed by the investor are calculated in the event he decides to finance part of the purchase, or to pay out the entire amount necessary for the transfer of ownership.

One notes that since the interest rate of the debt is less than the growth rate of the value of the property, the leverage works by amplifying the gain on the capital invested in the purchase of the land.

Table 3.2 Cash flows as a function of investment alternatives

	With loan	Without loan
Revenue from sale to the 5th year	€1,200,000	€1,200,000
Accumulated debt to the 5th year	−€692,381	€0
Cash Flow to the 5th year	€507,619	€1,200,000
Committed capital for purchase	€150,000	€600,000
Rate of return on invested capital	27.6 %	14.9 %

3.2.1 The Measure of Leverage

A favourable financial leverage is an assumption that is based on a prediction that by its nature is uncertain. If the estimates on revenue had been too optimistic and net income falls below the cost of the loan, the negative consequences of this wrong investment strategy grow proportionally with the amount of debt.

The leverage works in both directions: it can turn a good investment into a huge success but can also change quickly into an unsuccessful investment. This means that, with increasing financial exposure, the spectrum of possible outcomes is wide, and this increased dispersion around a desired outcome involves the raising of the level of risk.

The level of leverage is measured by the relationship between the equity and the total value of the properties acquired. Some of the most commonly used indices to represent this relationship are the debt-to-equity ratio, i.e. the ratio between the funds borrowed and the funds committed by the investor directly (self-financing), and the ratio between the amount of the loan and the value market of the properties being financed (loan-to-value ratio).

The second of these indices is a measure of the safety margin to guarantee the lender in the event of failure of the operation. In a possible auction of the mortgaged property, the lender expects to recover the money granted to the insolvent. The loan-to-value ratio is, therefore, an expression of the risk of being unable to cover the total amount of the loan through the sale of the asset financed.

Into investment analysis, loan-to-value ratio performs a different function: it provides a measure of the value of real estate that can be controlled with a given amount of equity employed. If, for example, the loan-to-value ratio available is 0.67, then the investor can gain control of about €3 of properties for each euro invested: $1/(1-0.67) = 3.03$.

Another useful parameter to define the risk associated with leverage is the debt coverage ratio:

$$Debt\ coverage\ ratio = \frac{Net\ Operating\ Income}{Debt\ service}$$

It is a measure of how net operating income may fall below expectations before it is insufficient to cover mortgage debt.

3.2.2 How Much Finance?

A favourable leverage magnifies gains on employed capital. However, there are limits to the amount of credit that lenders are willing to concede. The first issue to be clarified is, therefore, what is the limit. Only then, will it be necessary to establish the convenient measure of leverage.

The property's capacity to generate a high enough cash flow is, for the lenders, a guarantee of the payment of debt instalments. In this sense, the coverage ratio of debt is a security measure related to the recovery of the loan. The banks often specify a lower threshold for the coverage ratio, below which they are not willing to grant the loan. By dividing the net operating income estimated for minimum coverage ratio, one can calculate the maximum annual instalment for repayment of the loan. Finally, once the terms of the loan are known, the maximum loan obtainable is determined (Example 3.3). In addition to a minimum coverage ratio, lenders usually also establish the acceptable loan-to-value ratio maximum. The amount of funding will be determined by the most restrictive of these conditions.

Example 3.3 From a survey in the financial market, it has emerged that the minimum debt coverage ratio is 1.2. The interest charged is 9 % per annum and the loan must be repaid over a period of 20 years with constant monthly instalments. It is estimated that in the first year, the property will generate a net operating income of €400,000.

The rate of annual depreciation may not exceed €400,000/1.2 = €333,333. This means that the maximum loan that can be obtained for the purchase of the property is:

$$€333{,}333 \times \frac{(1+0.09)^{20}-1}{0{,}09 \times (1+0.09)^{20}} = €3{,}042{,}845$$

Assuming that the property has a value of €4 million and that the maximum loan-to-value ratio is 0.7, then the amount eligible for financing will be limited to 0.7 × €4 million, amounting to €2.8 million, instead of the approximately € 3 million fixed based on the index of debt coverage.

3.3 Financing Costs

The investor who uses a loan must bear a cost that depends primarily on the amount of money received. With the increase of amount financed, the lender requires higher earnings to compensate for the higher risk exposure. These can be

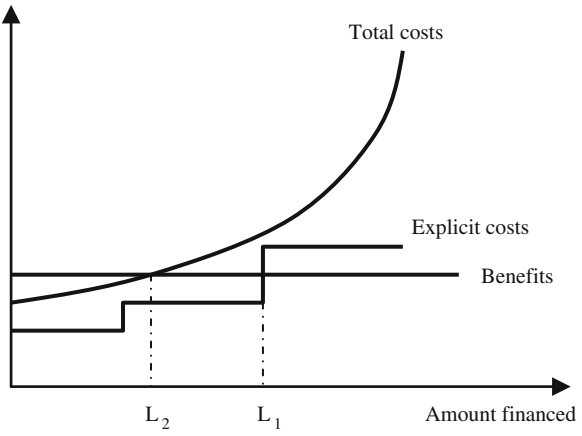


Fig. 3.1 Cost of financing

obtained through the tightening of bank fees and the interest rate charged. This results in increased explicit costs (those loaded by the creditor).

The investor should also consider the rising implicit costs, due to the need to compensate for the additional risk to the investor, linked to the use of borrowed money.

The explicit costs, as seen in Fig. 3.1, follow a pattern with jumps set to the limits of the different financing thresholds. Since the source of the funds does not affect the results of the investment, the line of expected returns assumes a horizontal trend. If the investor did not consider the financial risk (implicit costs), the lever would be pushed to point L1 where revenues are equal to explicit costs associated with the loan. This type of situation maximizes the return on equity capital.

The total cost curve also incorporates the implicit costs of uncertainty, and describes a situation closer to reality. The optimal level of funding is reduced, in this case, to L2.

The explicit costs do not end with the payment of the interest on the amount financed. In fact, the lender updates the debtor of additional costs through the imposition of bank charges, taxes to pay off the liability and the possible penalties for early repayment of the amount lent. One must distinguish between the interest that is stated in the contract (effective interest rate) and the annual percentage rate (APR). The latter represents the true cost that the borrower must pay for the use of borrowed capital, because it generally incorporates one-time charges such as front-end fees.

The additional charges reduce the amount available to the debtor at a fraction of the amount stated in the contract. The APR, therefore, is always higher than the effective interest rate. Example 3.4 clarifies this situation.

Example 3.4 An investor signs a mortgage loan of €100,000 to be repaid with constant monthly instalments over a period of 25 years. The effective interest rate is 9 %. The creditor demands a fee of the borrowings amounting to 2 % of the amount financed.

$$monthlyinstallment = C_o \times \frac{r/12 \times (1 + r/12)^{12 \times n}}{(1 + r/12)^{12 \times n} - 1} = €839.20$$

C_o = €100,000
r = 0.09
n = 25

The debtor has the availability of only €98,000:
€100,000 − (0.02 × €100,000) = €98,000
The effective interest is calculated according to the monthly payment of €839.20 and the amount of €98,000. By solving the above formula with respect to the interest rate:

$$€839.20 = €98,000 \times \frac{r_e/12 \times (1 + r_e/12)^{12 \times n}}{(1 + r_e/12)^{12 \times n} - 1}$$

One gets a monthly interest (r_e/12) of 0.77 % and an annual percentage rate $APR = r_e/12 \times 12 = 9.25$ %.
One has to refer to this rate to make comparisons between the different financing alternatives. Of course, the choice between various possibilities of loan is also based on other parameters (amount granted, the period of amortization, collateral requirements, and penalties for early refunds, etc.).

Among the factors that have greater influence on the rate of interest is inflation. The lender is induced to compensate for inflationary expectations, increasing by a few points the rate applied. This is justified by the fact that the money lent will be returned when it will have less purchasing power. Therefore, a nominal interest rate I_n is distinguished from a real interest rate Ir, calculated as follows:

$$I_r = \frac{I_n - p}{1 + p}$$

where p is the inflation rate.

In periods of low inflation (rate close to zero), it can be assumed that the denominator is close to 1, so a good approximation the formulas become:

$$I_r = I_n - p,$$
$$I_n = I_r + p.$$

Chapter 4
The Real Estate Investment

Abstract The chapter deals with the characteristics of the investment property. The specific risks associated with the investment property are shown, as well as the advantages and disadvantages compared to other types of investment. The meaning of investment value is explained in general and, with reference to real estate investment, the parameters that affect this value are identified.

4.1 Features of the Property Investment

The investment involves the sacrifice of something in the present (not only economic resources) with the prospect of obtaining benefits in the future. These benefits can occur in three ways:

- An income stream;
- A return of capital;
- A psychic income (Baum and Crosby 2008), a feeling of satisfaction induced by the possession of an investment project.

The first two factors are those assets that underpin the investment analysis. The last factor cannot be measured in monetary terms, but its importance for the investor can also be significant. The psychic income assumes, in general, the form of prestige value that adds value to the quality of the investment property.

No discussion on the subject of investing in real estate can disregard a fundamental consideration: Each property is unique and therefore requires a specific analysis of its characteristics (in particular, those related to the place where it is located). However, the value of a real estate investment is influenced by elements that can be considered common to all types of operations of this sector. Some of these features have already been introduced above and are repeated in Fig. 4.1. The fixed position, already discussed, then determines that:

B. Manganelli, *Real Estate Investing*, DOI 10.1007/978-3-319-06397-3_4

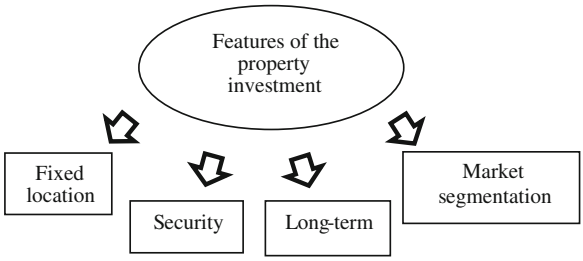


Fig. 4.1 Features of the property investment

- The marketability of the property is greatly reduced when compared to goods that can be easily transported from one market to another;
- The value is subject to any change of a political, economic and demographic nature that regards the market area in which the property is located.

Furthermore, the fixed location is one of the factors, along with the permanence of the land, which makes real estate the best guarantee for mortgage financing. These are important elements of the investment property, which by its nature involve rather large amounts of money. The use of financial instruments determines an additional cost to the investor.

The investment in real estate, in relation with to the permanence of the land and the long duration of the structures built on it, is considered a long-term investment. Precisely the longevity of the property as well as the features of the real estate market allows investors to assess, obviously not without risk, the present value of the income stream that the property will produce in the future.

Another characteristic of the real estate market that strongly influences investment decisions is the segmentation. The real estate market is a combination of submarkets divided by product type (apartments, commercial or industrial premises, etc.), by quality and by location. These sub-markets react promptly, but not in the same way, to changes in local economic and social activities.

Further elements that contribute towards the complexity is the lack of standardization of the product and the tendency of some operators to act in an intuitive way, paying little attention to formalized methods of study of financial feasibility. It is an attitude that feeds the market imperfection and does not give the option of checking, exploiting the advantages of a serious analysis, the risk involved in the investment.

The risk factor, despite the common idea of security associated with the investment property, greatly affects the feasibility and profitability of an operation. There are many risk classifications in the literature. One of these refers to the diagram of Fig. 4.2 (Sirota 2013).

The structure proposal is very simplified, but lists some of the most important risk factors to be taken into account in the choice of an investment. In the following paragraphs, the risk factor is better analysed.

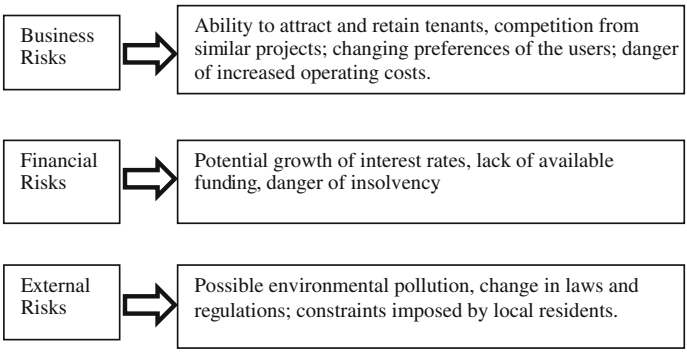


Fig. 4.2 Risk classification

4.1.1 Classification of Investments

The interventions of real estate development can be distinguished, depending on the financial characteristics, into three main classes: commercial, almost commercial, non-commercial (Fig. 4.3). The first category, which focuses on this exposure relates to those initiatives that aim to achieve a return in terms of income, or any other monetary benefit. The investments of a commercial nature against the performance of a set of activities and operations using a limited amount of resources will have to produce goods able to be absorbed advantageously by the market. It is therefore necessary to acquire a thorough knowledge of the quality and quantity of the product to offer, the price of use and exchange, marketing conditions, and future demand.

4.2 The Reasons for the Investment

The primary reason for investing in real estate is undoubtedly the almost absolute certainty of the preservation of the capital invested. It is observed that the values of the properties fluctuate according to the cycles of the local market; however, they still show a tendency to increase in the long term. Consequently, the real value of the capital invested, is guaranteed. A study on the Italian real estate market (Manganelli and Tajani 2010) has identified inflation as the macroeconomic variable that has the most influence on the dynamics of quotations related to the residential market. The relationship between the latter and the values of the residences is reversed, this confirms what has just been mentioned, namely that property is considered a good investment that will protect the capital from the phenomenon of inflation.

Another reason, complementary to the first, which in fact motivates each type of investment, is the expectation to make a profit on the investment.

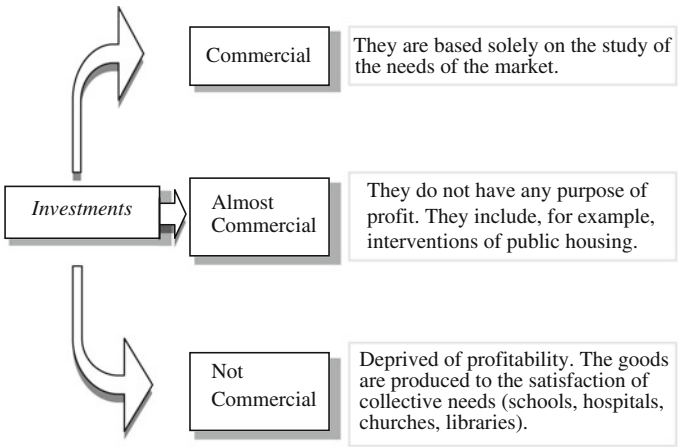


Fig. 4.3 Classification of investments

Thus, real estate investment can take on two forms. The first comes from the income stream that is obtained by renting the property. From gross income, derived from the payment of the fee, operating expenses necessary to maintain the value of the capital invested must be deducted. When the property is sold, the sale will allow for the recovery of the invested capital and a further gain following an increase in the real value of the property will be obtained at the end of the holding period. This gain (capital gain) is the second form of profit that the investor aims at.

Figure 4.4 shows that the first form of profit (rental income as a percentage of invested capital) is not very variable over time. The estimate of the cash income generated by the property can therefore be regarded as affected from a low degree of uncertainty. On the contrary, the rate of profit is very variable, and is related to the capital gain, which in particular economic conditions or if sales were to occur in the descending phase of the real estate cycle, could turn into a capital loss. This variability is therefore one of the elements that characterize the riskiness of the investment property.

4.2.1 Advantages and Disadvantages of Investment Property

Because of what has been described, one can deduce that the most important advantages of this form of investment are related to the ability to preserve capital by inflation, connected to a low risk profile, which has a good chance of funding being provided.

To these advantages, there should also be the possibility of investing in real estate to have a significant personal control over project management and capital invested. The investor; throughout the holding period, can and must make decisions about the best financing necessary for the acquisition of the property, the

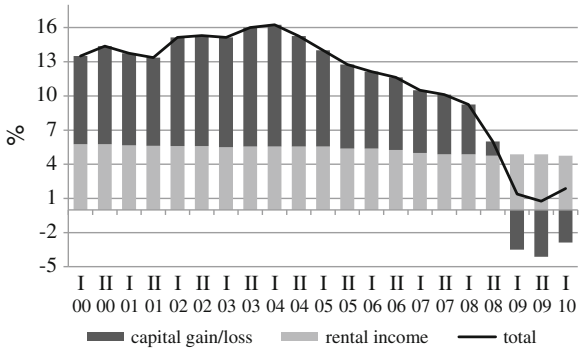


Fig. 4.4 Returns on investment in real estate

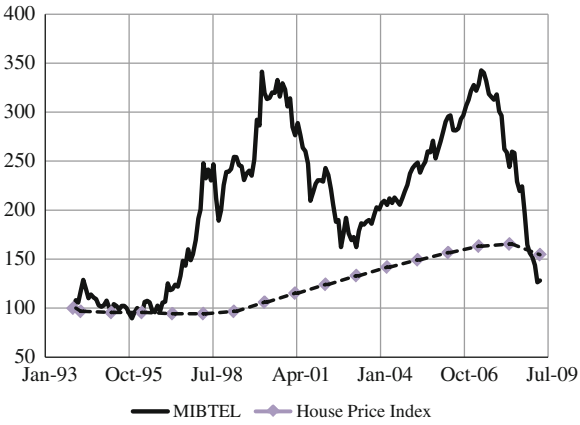


Fig. 4.5 Trends in real estate prices and stock market in Italy

administration that ensures the achievement of the objectives, the terms of the sale of the project, etc. The many variables that one can handle, allow to fully control the entire development investment.

Finally, among the reasons that can justify investment in real estate, especially for those who want to make their portfolio efficient, there is certainly a low correlation with other investment opportunities[1] (Fig. 4.5).

[1] While on the stock market, data on returns and trading are widespread minute by minute, the price index and therefore the information on revenues from investment property is updated according to estimates on a weekly, monthly or semi-annual basis. This causes a leveling out of the performance of these indexes and makes it seem as though the real estate returns are less volatile than what they are shown to be, through a more frequent updating of the values. However, such comparisons, though flawed, are essential for decision-making in the management of a portfolio. In the United States, the strong involvement of institutional investors in the real estate business has greatly contributed to the development of methods for comparison between different types of performance. In any case, the success of these techniques is subject to the update rate of the data.

However, some disadvantages characterize investment in real estate. While it is true that real estate investing allows for a high personal control, on the other hand, the investor should be ready to have a more active role in managing the investment.

Another disadvantage is connected to the characteristics of the property (non-transferable and indivisible) and the resulting strong segmentation that reduces the size of the reference market. It may therefore occur that a property up for sale is not sold immediately. The real estate investment therefore has a poor attitude to be readily converted into cash and, as mentioned above, there are no certainties with respect to the final sale price; it may happen that the sale occurs with loss of value. This feature is called liquidity of the investment and it distinguishes this investment, little liquid, from other types of investment, which are carried out on very vast markets able to quickly absorb the trade orders.

Real estate is among the most common opportunities, the investment is distinguished by the lowest degree of liquidity.[2]

In addition to the lack of liquidity, investment in real estate has a negative feature: that of requiring the use of large amounts of money for the acquisition of property. While it is possible to resort to relatively important financial levers, this does not waiver the investor from the significant commitment of funds. The purchase costs are added to the considerable costs for market analysis and to the transaction costs.

Real estate should continuously be subjected to routine maintenance and repairs, in order to maintain the property's value over time. This involves expenses incurred but necessary to ensure an adequate flow of rents and subsequent to meeting the needs of the tenants. In other words, the real estate investment requires active participation by the investor. Such management can be transferred to a professional who is responsible for administering the property on behalf of the investor, but the expenditure for this service would affect the income stream.

The commitment of the owner may also occur through forms of personal involvement in dealing with tenants and/or with the administration building. It must be said that these relations are not always simple and rewarding, and indeed can become stressful, especially in situations of disagreement. Exposure to complaints of tenants and the problems of Property Management act as a deterrent to investment property.

Likewise, if on the one hand the risk profile of the investor in real estate properties is quite low, the need for strong employment of capital involves excessive concentration of risk. The same capital could be used in more investment opportunities thus differentiating the risk, or remaining in the same industry

[2] Fraser (1985) asserts that the importance of the liquidity factor is mitigated by the fact that the transactions are less frequent than those of the securities market; likely, however, the low frequency of the negotiations was due to reduced liquidity. On the issue of liquidity and how this feature of the housing market is related to the labor market and geographical mobility; see also Head and Lloyd-Ellis (2012).

Table 4.1 Executive summary of the characters of an investment property

Advantages/Benefits	Disadvantages/Costs
Good protection against inflation	High entry threshold
Risk/return profile intermediate between stocks and bonds	High costs of research for market analysis and high incidence of transaction costs
Low correlation with other forms of investment	Excessive concentration of risk
Large market size (segmented by size, intended use, geographic area, etc.)	Stiffness: the leases are long-term
Funding opportunities	Low liquidity
High degree of personal control	Constant commitment management

but amplifying the use of capital, one should be buying more "diversified" real estate for use and location to have an efficient portfolio.

Even the guarantee of a future income that varies slightly due to the fact that it is tied to a lease contract, which is usually long-term, reduces the risk in the financial analysis of the investment. On the other hand, under favourable economic conditions the same condition would force the loss of possible higher profits. Table 4.1 shows a summary of the aspects that distinguish the real estate investment.

4.2.2 The Value of Investments

The investment choice is the result of an evaluation. The latter, in turn, precisely because it is developed to support a choice, is an evaluation of economic convenience.

Evaluations of economic convenience are distinguished from the "estimates" the results of which are generally valid, that is, accepted by the majority of the market operators. However the evaluation of convenience always refers to the person who commissioned it (to his economic characteristics, to his attitude to risk, to his managerial skills, etc.), it is specifically valid and always involves a comparison between alternatives. Of course, the alternative may be configured with another investment opportunity or with zero alternatives; that is, decide not to invest.

The same property subject of the investment, when placed on the market for sale, is then subject to a valuation aimed at the prediction of the most probable market value. The seller is interested in knowing the equivalence between the property and the amount of money that will allow the exchange, on the valuation date (or in the near future), with an independent party interested in buying after adequate marketing, during which the parties (seller and buyer) act with equal capacity, prudently and without compulsion. Likewise, an investor interested in entering the same property in his portfolio will evaluate the convenience to buy.

This evaluation involves a comparison between the market value and the investment value. A particular investor attaches this value to a property for specific operational objectives.

The value of investments is therefore not related to the most probable market value. It measures the importance, for the investor, of the flow of benefits that the property will produce in the future; therefore, it reflects the assumptions that the investor makes about:

- The ability of the property to produce income;
- The most likely holding period;
- The final sale price;
- Taxation;
- The financing instruments available.

These factors influence the net benefits arising from the ownership of the property. Because some of these elements depend on the economic and fiscal investor's condition; the investment value is specific and different for every investor.

It corresponds to the highest price that the investor is willing to offer for the purchase of property as the result of an analysis that involves, along with the variables listed above, the expectation of profit.

The buyer, on the other hand, is opposed to the seller who considers the costs and benefits associated with the maintenance of the property or divestment. If the value of the buyer's investment V_b is higher than that of the seller V_s (Fig. 4.6), there are the conditions to materialize the sale of the property, at a price that will be placed within the range of fluctuation defined by V_b and V_s The final price (net of transaction costs) will depend on their ability to conduct the negotiations, but certainly both the seller and the buyer will benefit from the deal.

The investment value is the result of a decision process developed with reference to specific individuals that engage in the following parameters:

- Amount of future benefits expected;
- Distribution of benefits over time;
- Confidence in earnings forecasts;
- Willingness to take risks;
- Return of investment alternatives.

Thus, for a given level of demand for space (from which the prediction of the potential profitability ensues), the real estate investor can establish a maximum threshold price deemed appropriate for the purchase of property to which it is concerned. When this value is higher than the market price, the investor may find it convenient to include the property in his portfolio. On the contrary, he might decide to sell when prices rise above his investment value. Clearly, if there is a greater difference between the most likely market price and the value of individual investment, there will be a greater potential profit for the buyer and the seller. However, the factors that affect the value of investment (rents, operating expenses, income taxes, and cost of capital) also affect the most probable market value. That

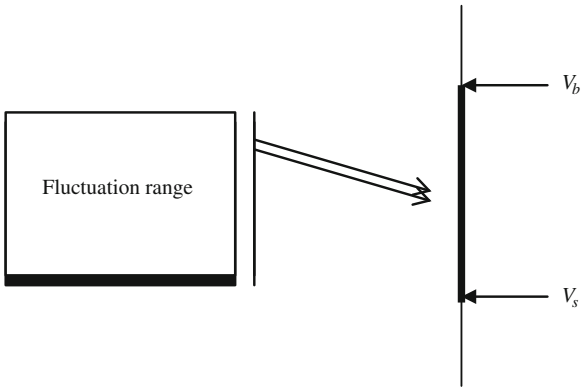


Fig. 4.6 The investment value

is to say that when the values of investment of market operators vary, buying activities cause movements in the same direction even in market values.

If the factors that influence investment values cause immediate changes in market values, the opportunities to achieve extraordinary profits decrease. However, if market values move with a certain delay, there will be more opportunities for profit.

The speed with which the market values react to changes to new information and to changes in demand is a measure of market efficiency. A market is efficient when all relevant information is an immediate effect in the prices. Those who work in an efficient market do not have the ability to make gains consistently above average. The possibility of extraordinary profits intervenes when few individuals know the relevant information.

4.2.3 Comparison with Other Types of Investment

The evaluation of an investment is—as mentioned—an evaluation of cost-effectiveness and as such involves a comparison with other alternatives or with zero-alternative. Before investing funds in the construction of a real estate project or purchase of a property, the investor should carefully consider the returns obtainable from other types of opportunities: bank deposits, stocks, bonds, government bonds, life insurance, etc. However, it should be stated that an immediate comparison between the returns obtainable from property investments and those of equities, bonds and other financial products, is hardly feasible, taking into account that the comparison should be developed, based on the characters that denote the level of investment risk. Among the financial products, government bonds are those to which a risk profile, very close to the ordinary real estate investor, is associated: they should also offer capital protection and the opportunity to make a profit. Nevertheless, an investment in property, capable of generating a certain annual profitability with the ability to recover capital at the end of the holding

period, is only apparently similar to investing in government bonds. One must remember that real estate investment involves a higher level of risk. The increased risk is related to the daily management of the property, the likelihood of collecting the rents according to the expected amount and the scheduled time, the future possibilities of actually recovering the investment and other unforeseen circumstances.

The effort required to personally manage the investment, the lack of liquidity and higher risk therefore imply the convenience of this investment, as an alternative to investing in government bonds, only in the event of a higher return compared to the last.

References

Baum, A., & Crosby, N. (2008). *Property investment appraisal* (3*e*). Blackwell.

Fraser, W. D. (1985). Gilt yelds and property's target return. *Estates Gazzette, 273*, 1291–1294.

Head, A., & Lloyd-Ellis, H. (2012). Housing liquidity, mobility, and the labour market. *Review of Economic Studies, 79*(4), 1559–1589.

Manganelli, B., & Tajani, F. (2010). Come le variabili macroeconomiche influenzano il mercato immobiliare italiano. *Rivista del Consulente Tecnico, 3*, 21–37.

Sirota, D. (2013). *Essentials of real estate investment*, (10th edn.). Kaplan.

Chapter 5
Investors and Investment Strategies

Abstract There is a close relationship between the risk attitude of the investor and investment choices. This means that the relationship between perceived risk and expected return is just as close. The concept of risk is therefore associated with the particular investor who in any case, regardless of a personal special aptitude, behaves in such a way as to minimize the uncertainty related to the activity to be undertaken. In this sense, the strategy of the investor becomes paramount. For this purpose, this chapter shows the basic steps of decision-making and the analysis activities that should guide the choice of the investor along this path.

5.1 Classification of Investors

The investor is the person or institution that engages in real estate resources with the aim of making a profit. Investors may be active or passive. Active investors acquire the ownership of the property in which they invest their own resources, directly. They supervise its administration or hire the professionals responsible for this task. They make decisions, select the staff to be hired, conclude contracts for the design, maintenance and construction, establish the rents and do everything that has a direct effect on the operating results. Passive investors do not take decisions but they delegate them to others. Investors may be of a different nature: building contractors, agencies, real estate funds, private. Each of them has constraints, motivations and different goals, but they all have, as common roots, the expectation of a financial return as a reward for the commitment of human resources and compensation for the risk incurred. The amount of compensation expected and acceptable level of risk depends on the specificities and attitudes of the individual investor.

Another distinction is between pure and real investors. The real investor is an economic entity, which basically performs the function of building (in practice the typical construction company). The pure investor, very often an abstract, is the one who is not directly involved in the operations of transformation of the

B. Manganelli, *Real Estate Investing*, DOI 10.1007/978-3-319-06397-3_5

building product, but decides to engage in an investment with the function of promoter and manager of economic activities in real estate in order to derive a profit.

5.2 The Behaviour of the Investor and the Risk Appetite

Risk appetite plays an important role in the choice of the investor. Some investors are inherently able to face the risk; they not only accept it but also seek it voluntarily. Other investors avoid it, they sacrifice the expected income in order to limit the most insignificant risks. The latter category of investors is inclined towards those products with a low return but of which they have a high warranty. Probably the majority of investors have an intermediate behaviour between these two extremes.

The investor behaviour has been studied extensively in economic literature and almost all the experts agree on a correlation between expected gain and perceived risk as shown in Fig. 5.1.

The investor tends to maximize profit for a given perceived risk, and he prefers to minimize the risks associated with fixed profits. The curve in Fig. 5.1 shows that, when the level of risk increases, the investor is willing to accept additional risk only if it is accompanied by, more than proportional, expected returns. At some point, a risk limit will be reached beyond which the investor will not go, whatever the extent of the possible but uncertain reward. Of course, the quantitative performance of this report will change depending on the risk appetite of the individual investor. The curve tends to rise with a lower gradient and will be associated with a person whose behaviour is characterized by a greater appetite for risk.

A greater appetite for risk does not mean 'bravery' or 'irresponsibility'. The investor is not a gambler and if his perception of the risk curve is flatter than average; probably he has information, experiences and additional analysis regarding the type of operation that he is going to undertake.

The concept of risk must therefore always be associated with the behaviour of those who invest. There are many studies in psychology that show the importance of the way in which risk is perceived and the relationship between risk and return in investment decisions in the stock market. These studies show results that are sometimes in contradiction; they point out that in relatively short periods, investors behave as irrational traders led by their "mixed feelings" or by so-called irrationality.[1]

[1] Mertz et al. (1998) and Slovic (2000) have shown that individuals rarely conceive risk as something objective and measurable. In addition, people have a tendency to avoid riskier alternatives. Ganzach (1999) stated that the report risk/return varies from subject to subject and in relation to particular situations, it may occur, therefore, that in some cases a higher risk does not correspond to a higher return. Otherwise MacGegor et al. (1999) assert that the equation risk/return is one of the decisive factors in the choice of investment, even if they demonstrate the existence of an asymmetry in the way in which the risk and the return affect this decision. People seem more willing to invest on the basis of expected returns rather than on the basis of the degree of risk inherent to a certain financial activity.

Fig. 5.1 Indifference curve risk-return

In the long run, any irrational deviation is filled and their behaviour, led by "common sense and economic rationality", once again reconverges with the results laid out by the studies and methods of Fundamental Analysis.

The behaviour of the investor, which is normally constrained to a significant financial commitment and long waiting periods in order to achieve the objectives, is consistent with this type of analysis. It is obvious that in this case the risk grows in proportion to the commitment of these resources: capital and time.

The generic investor in any case, regardless of his particular mind-set, has the duty to minimize the uncertainty of the activity to be undertaken, and if possible to transform the remaining uncertainty in risk.

While under conditions of uncertainty, the economic operator is not able to associate a probability to future events taking place, the risk is, instead, the measure of the probability that the future event takes place.[2]

The risk control passes through the respect of some general rules, which all investors should follow before committing money:

- Specify the objectives of the investment and in particular the minimum expected profitability, the maximum time to obtain the return of the invested capital and the level of acceptable risk;
- Identify the main sources of risk and try to quantify them;
- Remove unnecessary risks, transfer some to other parties (insurance, tenants, lenders, etc.) and constrain those who remain within acceptable limits;

[2] Knight F.H. in the 20s published, in his book *Risk, Uncertainty and Profit*, the first economic definition of risk: The uncertainty should be considered in a sense radically distinct from the familiar notion of risk, […]. The essential fact is that "risk" means in some cases a quantity which can be measured, it will be understood that measurable uncertainty, or properly "risk" is so much different from a non-measurable uncertainty, which in fact is not an uncertainty.

- Make the final decision verifying that the expected profits justify the risks borne, or that the investment meets the objectives.

These rules are formalized in a decision-making model to help those promoters of a real estate project, who must deal with very complex problems.

5.3 The Real Estate Development Process

Each category of property has, from the point of view of economic characteristics, some general concepts, which are common to all types of projects. Figure 5.2 shows the diagram of the typical real estate development process.

This process is generally applicable to most of the interventions. The promoter, according to its peculiarities, may decide to carry out all, or only a part of the phases of the scheme. More frequently, the process in its various stages is implemented by a variety of subjects. The operations to be carried out are essentially:

- The acquisition of the property (land, building, etc.);
- Transformation of the site and construction of buildings;
- Completion of the external areas and preparation of space to rent them;
- Property Management at the end of the rent phase;
- Total or partial sale of the structures built.

In theory, the promoter may choose to sell the project at any time. Such decisions depend on the activity carried out mainly by the operator, by his financial significance and, therefore, his business strategies.[3]

Some entrepreneurs undertake a building project with the intention of maintaining the property and administering it for many years after its completion. They consider the rent and the administration as integral parts of their business. On the other hand, other operators, who are more similar to small-sized building companies, build in accordance to the specific requests of a customer. In between these extreme categories, there are the promoters with intermediate characteristics and slightly different objectives. Most of them specializes their activities within one or more phases of the previous diagram. Those who intend to sell immediately after construction rely on external professionals, such as architects, real estate brokers and agents, to achieve many of the stages from III to VI. On the other hand, large companies consider most advantageous to carry out all the stages of the process, using outside contractors only when it is most advantageous.

Figure 5.2 illustrates a typical risk scenario in a "normal" market, in which it is expected that the demand for rented premises is sufficient to justify intervention.

[3] For example, the typical building contractor is a "real" promoter (in fact he mainly carries out the construction activity), and is generally directed to selling the property directly after completion.

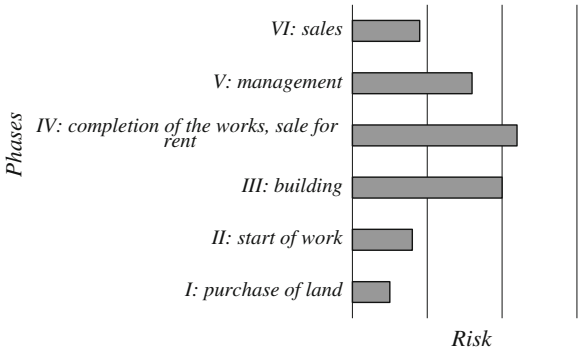


Fig. 5.2 The risk in the phases of the real estate development process

The risk begins with the acquisition of land and grows linearly during the construction phase until the first proceeds are realized. In the early stages, the main risks are related to construction delays, increases in the price of materials and/or the interest rate. Once the properties have been rented, the administrative procedure starts. At this point, different scenarios may arise therefore outlining conditions of greater risk. A favourable situation occurs when an increase in the demand for space produces revenue anticipated, but not expected. Obviously, the case where the demand and therefore the expected revenue decreases, would be unfavourable, and so would an unexpected protraction of the time needed to put up for rent.

The analysis of the market becomes therefore essential to reduce the risk of an investment.

For example, it is important to assess the viability of the construction industry, by estimating the demand for space (with reference to the destinations one wants to make or buy), through the detection and analysis of a series of parameters, such as the rate of employment, rents, or the volume of rents (or sales).

The demand for space should be assessed with reference to a rather distant future time horizon: if this were to go down, even after all the spaces are leased, the rental fees would decrease and the tenants would re-enter the market to find the best solutions. Therefore, a project is vulnerable to competition throughout its life cycle. This is one of the reasons why many promoters, who are unwilling to bear the risks of long-term management, prefer to sell immediately.

The risks arising from fluctuations in demand and from the administrative activity are not the only ones to encumber on a real estate development project. In addition, the location of the site to be purchased for the project is of paramount importance. Spatial proximity to other structures, or in the centre of the activities of an urbanized area, has a significant effect both on demand and on the final value of the project.

Investors should also carefully examine the demand for space in qualitative as well as quantitative terms. In turn, this demand depends on the characteristics of the potential tenants (or buyers). Only by knowing the economy of a particular

place and the nature of its working world, a promoter can accurately predict demand and satisfy it by providing spaces with the right combination of quality and quantity and therefore at the right price.[4]

5.4 Objectives and Strategy of the Investor

Contingency planning should include a range of alternative uses of the buildings in the event of failure of the plan. In the planning phase of the intervention, it is appropriate that the design complies with the principles of convertibility (functional flexibility and adaptability) and the substitutability of the building components. The ex-ante substitutability dictates the use of items, materials, equipment that can be replaced without compromising the functionality of the property and without excessively impacting on future maintenance costs.

The specific objectives of an intervention in real estate development, and the macro-strategies to achieve them, change depending on the characteristics of the client. Notwithstanding that, the main purpose of any private operator remains the identification and development of "opportunity" able to offer a profit higher than the normal rate of return expected. All decisions, typical of business strategies, could diversify greatly, being influenced by different peculiarities of the operators (financial dimension, type of function mainly carried out, etc.). On the other hand, the previous standardization of subjects that operate in the real estate market helps to understand the mechanisms underlying the initiatives and the decisions taken by different promoters.

For example, in the case of a "real" entrepreneur, the layout of the plan should consider that:

- The construction activity manufactured in-house is the component of greater importance, in fact one has the best information about it (e.g. construction costs);
- It is preferable to minimize the financial exposure (especially if the business is small in size);
- The minimum threshold of profitability is probably less than that of a pure promoter.

However, a promoter with greater financial capacity will invest in relatively more complex and extended operations. In fact, considering that the bureaucratic process for obtaining all approvals by the Public Administration, in the case of large projects, is often burdensome and involves a significant expansion of the times for the onset of the works, this type of investment can be undertaken only by those who are able to

[4] Please note that in countries where labor mobility is common (e.g. the USA), the decision of a family to transfer their residence depends not only on job prospects but also on the relative cost of the house (Zabel 2012).

expose themselves financially, in the face of uncertain temporal prediction (assuming that the risks are outweighed by a sufficiently high yield).

Many of the strategies, used by investors in the real estate market, trust the inefficiency of the market. Inside, the most cunning individuals, those who are able to anticipate market trends, manage to gain profits that would not be possible in conditions of efficiency and balance.

In an efficient market (that is, one in which all relevant information is immediately available at a limited cost), the higher offers come from those who derive the greatest benefit from the property to buy. This does not happen in the real estate market.

In a balanced market, companies earn enough to maintain a certain level of production but not enough to be able to expand. The situation in which, in an atomistic and efficient market, companies can gain more profit than is required to keep them in business is to be considered provisional.

In the real estate market, characterized by continuous fluctuations, what is to be considered "temporary" is the equilibrium condition instead. In this situation, the difference between success investments and disastrous operations can be determined by the ability of adaptability of companies, or by the ability to occupy market niches vacated in periods of transition, exploiting in their favour, the moments of general disorientation.

Of course, information research plays a fundamental role for those looking to take full advantage of periods of confusion. Consider, for example, the case that a company operating in the rental market discovers, through investigation, the possibility of inducing tenants to pay a higher fee by equipping apartments with a new air conditioning system. The marginal cost of this intervention would therefore be less than the marginal revenue generated by it, and this would result in an extra profit.

In an efficient market, the competitors would rapidly follow the demand and the new air conditioning system would soon become a standard feature. This would lead to an increase in supply, which in turn, by pushing down rents, would ultimately cancel the extra profit. The example above shows that entrepreneurs exploit the inefficiency of the market during the time needed to reach a new equilibrium; in fact, they take advantage of the premium related to innovation. The continuous search for innovation allows them to position themselves in a niche inefficient market where they can act in conditions of temporary monopoly.

Investors, who have preferential access to information (being able to obtain it more quickly or at lower prices than the others) do not need to use innovation to gain profits.

An excellent knowledge of the market is the key to improving the outcomes of long-term investments such as those in the real estate market. At a macroeconomic level, it is important to understand the rules that govern the fluctuations of supply and demand, while at a local level it is essential to upgrade the cognitive framework of the condition (building structure, demography, urban planning, economics, etc.) for the specific market area. In this way, one can identify the most profitable investment opportunities and reduce the margin of error.

The pursuit of profit can also pass through the instrument of marketing. The fundamental purpose of marketing is to inform the public and, in particular, potential clients about the market entry of the new vendor products and services. However, one should not think that this type of advertising exhausts the promotional phase. In some cases, being successful in real estate investment can be very complex. For this reason, professionals such as brokers (brokerage) carry out a promotional function; they are hired to perform most of the activities related to the alienation of the property. The brokers sell a service to property owners and generally operate in areas of a limited market of which they have an excellent knowledge. In their activities, they resort to the media or to direct contact. In order to get advantageous leases or sales, it is definitely necessary to advise all potential buyers or tenants through advertising channels, but it is equally important to use the advertising message to highlight those characteristics that can address the choices.[5] Market participants know that the customer is a lot more sensitive to price differences rather than to minimal "differences" in the characteristics between products joined by a chain of substitutability. To fill this different sensitivity, the characteristic aspects such as architecture, the quality of the building materials or the luxury accessories should be emphasized. It should be noted, moreover, that the physical differences might have less weight compared to those that exist only in the perception of demand.

Competitors can duplicate the design, quality and functional features of a property. The same cannot be said for the image (reputation), it is a unique element of a property, which is sometimes consciously created in order to affect a specific market segment. By defending the reputation of a property, one can have the option to rent or sell it at higher amounts than the competition. In this way, one catches part of those monopolistic advantages that result from characters of the uniqueness of the property (the position, for example), decreasing the vulnerability to competition.[6]

[5] It may happen that the brokers are forced to mediation efforts and particular strategies, which obviously require a longer contract period (increase in the time of sale), from sellers that impose starting bid prices higher than the normal market values. This situation triggers a mechanism that brings—in normal cyclical phases—to higher selling prices (Anderson et al. 2013).

[6] Proof of the quality as a driver of demand can be provided by measuring the standard deviation of the real estate prices. This measure of the variability of prices in the cities is an indicator of the selectivity determined by the quality, with an increase in the demand for quality, so does the variability of prices. With reference to the last expansion cycle of the real estate market, to which an intense recovery and urban regeneration corresponds with projects often implemented through the work of famous architects, it can be seen that prices tend to differentiate more and more around their average values and for all types of real estate (Adair et al. 2003).

5.5 Choice of Type of Intervention and Location

Even if bound by building regulations and planning instruments, the choice of the location where to carry out an intervention in real estate development is first and foremost a business decision. This is why the model of urban development, despite the overlap of political restrictions, is an expression of economic forces. One of these forces, which becomes more and more evident as the city grows, is the functional specialization of areas. This trend can be seen not only among the general categories of use—residential, industrial and commercial—but also within the categories themselves. In the choice of a home, for example, one may notice a fragmentation into social and economic classes: there are distinct neighbourhoods depending on the size and quality of housing. Something similar happens to the commercial districts. The specialization of use dictated by the market is never final; variations in the level of economic activity, combined with the perpetual change of technology and lifestyles, leads to the passing of the old positional choices and the need to adapt, even at considerable cost to the new conditions.

Ultimately, the use of land is affected by the efforts to produce an economic advantage and is subject to anomalies due to errors of judgment and irrational elements. In this condition, there is a general rule that is always valid: the properties are purchased or rented by those who can pay the highest price (or charge). The consequence is the formation of a pattern of land use rules that, at least in theory, generates the highest economic benefit to the entire community.

Of course, not all potential users directly compete for the same space. For example, although the railways and highways reduce the desirability of the adjacent residential neighbourhoods, large warehouses and industries benefit from proximity to these transportation networks. Similarly, if on one hand affordable housing is constructed preferably on flat land to minimize construction costs, on the other, wealthy buyers are willing to pay a premium to enjoy the excellent view of an apartment located on a hill just outside town.

However, in general for some functions direct competition exists. When the competition is based solely on economic considerations, the pattern of land use is logically dictated by the highest paying capacity, or by choices that tend towards the maximization of profits.

Although a merger is a natural fit to the needs and the desire to minimize transport costs, decentralization remains a necessity for some productive activities. Those who, by taking greater benefits from close proximity to the city centre, can afford to pay higher prices move these activities to areas with a lower building density. The building density tends to be higher in the centre of the market activity and lower as one moves away. All this is in agreement with the theory developed about 190 years ago by Von Thünen about the use of land.

He theorized the concept of rent by linking it to the demand for the location of an economic activity and to a consequent recognition of it as criterion for the spatial distribution of these activities. Taking as a model an isolated economic area formed by an urban core surrounded by a uniform plain, Von Thünen showed that,

under certain conditions, the choice of use is directly attributed to changes in transport costs; he also showed how, under equal conditions, lands closer to the central market were the most intensively exploited. One can consider, therefore, an urban development model made up of concentric rings with homogenous uses, with a lower building density for the outer areas. In the early sixties, the model of Von Thünen was taken up and adapted to an urban context by Alonso (1964).

Alonso adapted the Von Thünen model to the urban case and generalised it by overcoming the hypothesis that only the shipping costs are expression of spatial impedance and of preference for more central locations. The land rent in this case is defined as residual and the entrepreneur determines it. The land rent therefore constitutes a transfer of income/profit from the transformer manufacturer to the owner of the land, after production costs, including costs of transportation and a certain profit that the contractor is not willing to give up, which are subtracted from the sales proceeds of the products of transformation.[7] This model is very consistent with the reality of American or Australian cities and this situation is common to every urban area, with the obvious limitations to the ring structure due to the topography and preferential transport corridors. Each city has its own downtown district where there are financial offices, and all activities that attract customers from the surrounding areas. The rents and the densely populated areas are very high.

Business activities are located outside the centre: some of them benefit most from their position along major traffic arteries (creating a radial or axial model of development).[8] Others, however, take advantage of the mutual neighbourhood: These activities are grouped by creating multiple nuclei and small towns scattered throughout the metropolitan area. Some stores seek to position themselves close to other similar businesses in order to capture the customers of their neighbours. Those stores, that offer the same kind of products, obtain and in fact benefit from the formation of commercial districts: collectively they are able to attract a greater number of customers than if they were more isolated. Once formed the nuclei they generate locally peaks in land values. Subsequently, the first cities expand along transport corridors and then occupy the spaces between these nuclei with residential projects and other commercial projects.

Below, are the principles underlying the choice of location of economic activities.

Firstly, consider the productive activity. Each company tends to optimize the production or minimize the cost of production. Among the elements of cost, which has a direct impact on the location, there is transportation. The need to move

[7] The model was then developed by Wingo who added, to the underlying assumptions, the hypothesis relating to the effect of the "free time" marginal variable on the budget as well as on the level of satisfaction (Wingo 1961).

[8] The models of Alonso and Wingo have been refined over the years, starting from the original town of concentric ring, the newer models make reference to the case of two or more independent centers of equal or different sizes, competing or complementary: the urban form results from these analyses dependent both on the transport network and the relationships between the different urban centers.

people and things creates costs that reduce the desirability of the sites. The ideal condition is one for which the activities are more closely related in the production process and are positioned in the same area. Yet, this is not always possible. Transport costs are both explicit (cost per km of the chosen mode of transport and the cost of time spent on the trip) and implicit (connected to the dangers and the general disutility of transport).

The location of a business can impact, both the transport costs, and the production costs which are relatively low for example, for a farm located on fertile land and on an area with a favourable climate. This can save a considerable amount of money compared to a less fertile location. The choice should therefore seek to minimize the costs of production and transport.

Figure 5.3 illustrates this situation.

In the absence of loads due to lease, the remaining operative costs as a function of the distance from the ideal, are obviously increasing. The ideal location, which coincides with the centre of economic activities of a city, is defined as the place where the net benefit is the highest in the absence of expenses for rent. Assuming further that the revenues are not influenced by the position, the place that minimizes the cost would coincide with the ideal (perfect) location.

The differentiation of rents is determined by the competition for spaces closer to the centre of economic activities. Simply speaking, one can therefore assume that a straight line descending represents the relationship between the level of rents and the distance from the ideal. If costs and rent are added, then the position that minimizes the total cost will be found at a certain distance from the ideal one (bottom graph in Fig. 5.3).

Companies that are able to obtain higher profits from the ideal position are able to coerce their competitors towards less attractive areas, but cheaper.

With regards to commercial property, the choice of a site involves the analysis of more complex variables. For example, fundamentals are the cost of transfer of potential customers: whoever goes shopping and has to decide which stores to visit considers the disutility (time, inconvenience, and cost) of travel towards the shopping area. Unlike the productive sector, for the commercial activities, the profit obtained from the sales are a function of the distance from the ideal position. This condition is illustrated in the graph of Fig. 5.4.

Curve A in Fig. 5.4 shows, as an example, the potential profit of a commercial company before the expenses of rental property as a function of distance from the ideal location. This curve also determines the maximum rent that a company can tolerate without endangering its survival. In practice, if the profit curve is below rent B (represented by a straight course and descending with increasing distance from the ideal), the company will be out of the market by those who are able to achieve from that position a greater profit. Therefore, only the areas corresponding to the segment of the curve that lies above the straight-line rents, represent choices for a possible positioning of the company.

The optimal position, which corresponds to the maximization of the net profit, is also, in this case, at a certain distance from the ideal one. In the absence of rental demand from other sectors of the economy, the commercial sector would be

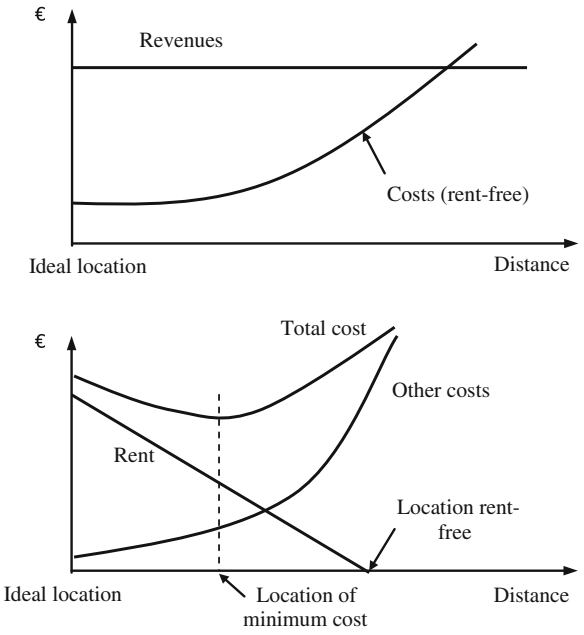


Fig. 5.3 Positional decisions of an industry

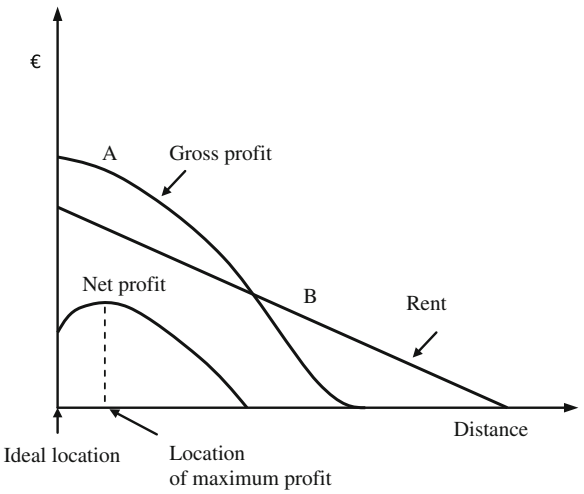


Fig. 5.4 Positional decisions of commercial activities

extended to the intersection between the curve of the net profit and the *x*-axis. However, bear in mind that in reality there are, in addition to the commercial activity, other activities such as industrial or agricultural which are competitors in relation to land use. All of these activities give rise to an equal demand curves corresponding to an offer of rent equal to the difference between revenues and

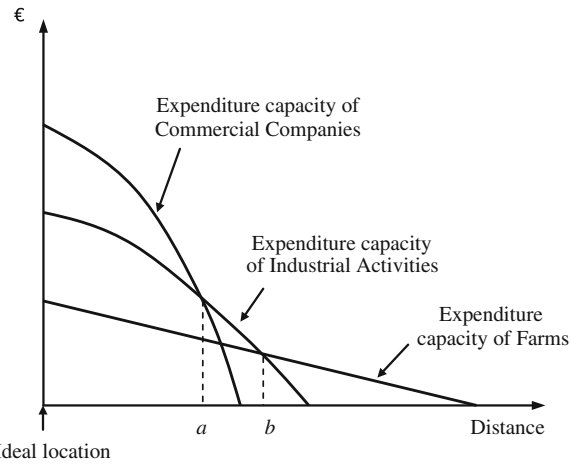


Fig. 5.5 Expenditure capacity on rent and zoning

costs (excluding the cost of rent and a profit margin). Figure 5.5 shows a possible representation of such demand curves.

One can see that industrial activities, by not having the need for an exasperated centralization, submit offers that, in central areas, are lower than those from the service sector. Beyond the point (*a*), the demand from the industry becomes more competitive at least until the corresponding curve is not surpassed by that of the agricultural sector (*b*).

Gross profits (before subtraction of the rent) of industry and agriculture are less sensitive to distance from the ideal, compared to what happens in the commercial sector. In areas closer to the city centre, industry has a capacity of spending less on rent than that of a commercial company. This spending power, in the proximity of the city, is even lower for farms, but since this capacity is less elastic to changes in the distance becomes greater than other industries for more distant sites.

This allows us to understand that, regardless of the zoning imposed by planning instruments, first and foremost economic considerations generate a different location between the various activities. In the complete absence of constraints the ideal location (the city centre) will therefore be occupied by commercial companies, the more remote areas will see the prevalence of farms, while in the intermediate areas the winning bids will come from the industrial sector. Since the market is never a perfect distributor of resources there will always be an overlap of uses in places of transition between predominant destinations.

In the programming of real estate development, one should not forget that the choice of site (or building to be redeveloped) and the quality of the project are dependent issues. It would be unreasonable to suggest the construction of a residential building of high quality within a popular neighbourhood. The probable and potential end user or the family who decides to reside in that neighbourhood has a lower-middle income, which forces them to steer demand towards a less refined but cheaper accommodation.

5.6 The Decision-Making Process

5.6.1 The Layout of a Pattern

The preliminary analysis of the technical, territorial, economic, financial and administrative-management of an operation real estate is the best guarantee of its future profitability.

During this phase, variables that may have an impact on the final decision are defined, measured or estimated. It is therefore essential to build a valuation model that allows for the identification of critical parameters, the quantification of parameters considered relevant to decision-making, processing of the information and ultimately the interpretation of the results to which it leads.

The choice of investment in real estate involves a preliminary analysis of information related to the specific market, the property that one intends to acquire and finally the desires of the end-users. The characteristic features of any investment are, first of all, the immediate commitment of economic resources that could have alternative uses, and secondly the prospect of possible but not certain future benefits. To an already generally complex problem, in the case of investment property, there is the added difficulty of working in an environment that has little or incomplete information. The previous chapters have identified the main elements that can affect the success of an investment property. One way to control these many interrelated variables is the implementation of a decision making process that highlights the fundamental problems of the intervention, in order to facilitate the definition of possible solutions and indicate the more affordable design alternatives.

A proposal is "feasible" if the analyst identifies the existence of a reasonable possibility that the results of the project are related to the objectives formalized by the investor in respect of the choices made in a context of limited resources.

The feasibility analysis, in the context of economic evaluations, is not to be confused with the exercise of the estimate. The latter is addressed to the determination of the property value. The evaluator does not consider the ordinary use for which the property is intended, but aims to identify the highest and best use for the property being valued, especially in relation to his management skills and economic capabilities. This implies that although in both cases the analyst estimates the flow of net revenue that the property can generate, feasibility analysis and estimation employ similar models but produce fundamentally different data.

A model of decision-making process relating to the generic investment is expressed in Fig. 5.6. Despite its complexity, the analysis of real estate investments is not fundamentally different from that relating to other types of investments, with regard to the decision-making process. The methodology used in the

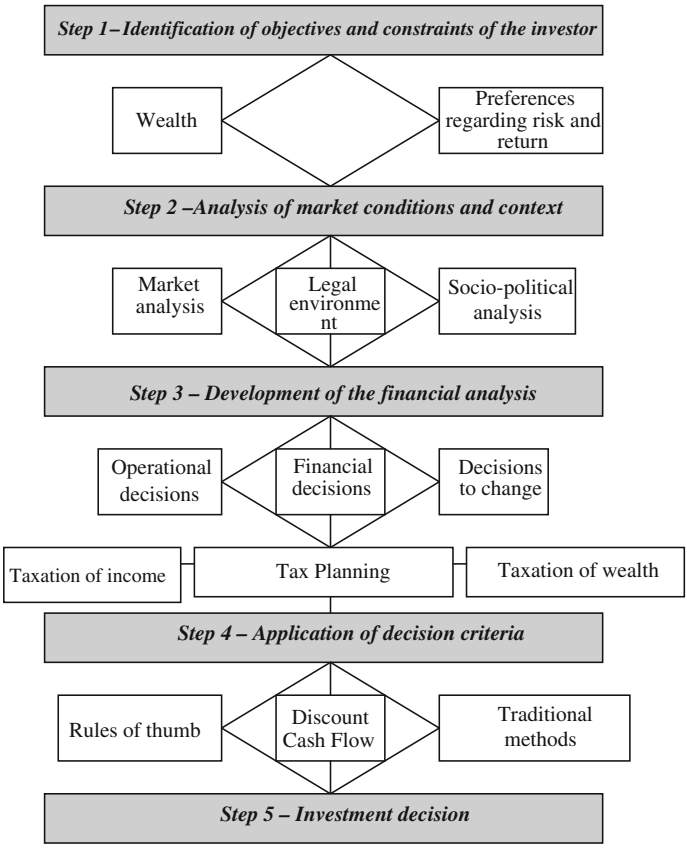


Fig. 5.6 A model of decision-making process relating to the generic investment

analysis, which is applicable to any type of investment and investor, can be divided into the following phases:

1. The definition of the objectives of the promoter;
2. The objectives are turned into development assumptions involving the implementation of analyses aimed at defining the market potential (to be related to the size of the project);
3. Economic verification and concept design; operations which are closely interlinked and require iteration to produce a solution: on the first design assumptions one operates a synthetic verification that, if positive, leads to the definition of the preliminary project and the final economic verification;
4. Obtaining government approvals with possible negotiation.

In fact, at every step of the way identified, an unsatisfactory outcome involves the redefinition and revision of the inputs of the previous steps.

The process then comes to the final decision in an iterative manner, by successive approximations.

In the particular case of an investment property, the decision-making process takes on characteristics depending on the type of intervention and strategies of the specific investor. In any case, it is always possible to recognize the activities, and the corresponding actions described in Table 5.1.

5.6.2 The Feasibility Study

The feasibility study can be defined as a technical-economic project to verify the existence of a reasonable chance of meeting the objectives of an investment through a selective action of mutual adaptation between solution implementations and limited financial resources.

The feasibility study can take many shapes and sizes but always and in every case, it has a multidisciplinary nature. Numerous skills regarding various disciplines converge in it, such as urban planning, architectural design, structural design, real estate appraisal, investments valuation, and with them the techniques that investigate and analyse the market. Although it cannot be excluded that one person can perform a feasibility study, competent in all these matters, normally a feasibility study is carried out by a group of experts from the disciplines mentioned under the guidance of a coordinator.

The feasibility analysis, of course, should not be seen from a purely financial perspective. The presented scheme shows in fact that a proposal is feasible if it:

- It is physically implemented, given the constraints of a technical nature;
- It is legally feasible, given the constraints of an administrative nature;
- It is financially sustainable.

In fact, there are numerous uses physically possible, but one can define feasible only those that are simultaneously feasible from both an administrative and financial standpoint (Fig. 5.7).

The proposed definition of the feasibility study includes some elements that require clarification.

When talking about a reasonable probability, it is intended that the absolute security of investment success never exists, that for the investor/owner there is always a risk that legitimates income or profit.

The term satisfaction means the attainment of the objectives within the margins of variability indicated by the study and accepted by the investor.

Investment objectives are usually the maximization of profitability, but investors can also specify different objectives, such as political, social, environmental, tax, etc. These objectives need to be clarified in advance between developers and executors of the study and, if there is more than one, they should be given with a specific priority order, and possibly with its own specific weight. The final solution of a feasibility study is therefore dictated by the objectives.

Table 5.1 Activities of the decision-making process for an investment property

Analysis of the technical sustainability and urban planning	Structuring of objectives
	Analysis of constraints and opportunities of the territory
	Defining the contents of project alternatives
	Comparison and verification of the alternatives dealt with the thematic areas of reference
Analysis of the economic and financial sustainability	Representation of spatial and socio-economic context within which the project will be realized with the identification of the objective, or system of the objectives that the project seeks to achieve
	Identification and quantification of existing and potential demand. Analysis of temporal dynamics, hypothesis formulation for its future performance, estimates of willingness to pay for goods or services obtained from the implementation of the project
	Analysis of the context of the financial resources available or enabled as well as the ways in which these resources will be granted (time and condition)
	Construction of a model of financial analysis that allows to perform, for the various design alternatives, the estimation of the cost-benefit, the calculation of the cash flows and the main indicators on the quality of financial management, the formulation of managerial hypotheses that imply the financial model, the verification of financial sustainability in a sufficient time period given the technical, economic and management characteristics of the project
	Construction of a model of economic analysis (cost-benefit), able to assess the suitability of the investment from the point of view of the public interest
	Development of an adequate system of simulations (sensitivity analysis and risk analysis), able to verify the financial and economic weaknesses of the project, estimating the likelihood of unsustainable economic and financial conditions
	Forecast models on the performance of the real estate market in a particular field, in a well-defined geographic area, with the use of macro-and microeconomic variables, qualitative and dummy variables: macroeconomic variables (e.g., inflation, GDP, unemployment, etc.)
	Microeconomic variables (e.g., migratory movements, companies and/or population, etc.). Qualitative variables (e.g., recovery projects of particular areas), dummy variables (e.g. regional and/or municipal regulations, etc.)

(continued)

Table 5.1 (continued)

Analysis of management sustainability	Mechanisms, procedures and organization of the system of implementation of the project
	The timetable and the procedures to be followed to activate all the contents of the project
	The identification of institutional and financial partners involved in the implementation and management of the project
	The procedures and operational instrumentations that are intended to be used in order to ensure efficient financial and administrative technical circuits, including any patterns of administrative acts that may be required by the Public Administration
	The means to ensure conditions of transparency and verifiability of the implementation phase; the procedures and systems of control and accountability, in analogy with the EU guidelines provided at the level of programming, to be considered in relation to the progress of the project

In the case of real estate investments, the study is normally aimed at finding a solution to one, or a combination, of the following problems, which is related to the fulfilment of objectives:

1. The site is predetermined: the objective is to select the best possible use of those. The investor must select those alternatives that best meet the utilization goals. Its physical and legal characteristics and its location (and thus the economic environment) constitute the starting point of the analysis.
2. The destination is predetermined: one must identify the location. It is imposed on the type of use of the property and one needs to identify the most appropriate site for its implementation. In this case, the initial data is the final destination and the characteristics of the economic environment.

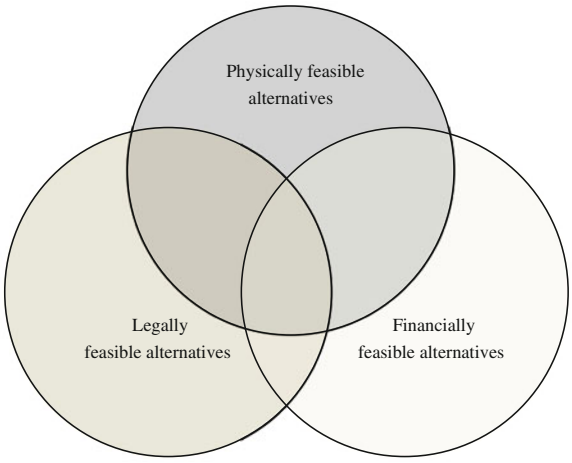


Fig. 5.7 Criteria of project feasibility

3. The funds available are predetermined: the objective is to find the best investment opportunities. The investor tries to identify which alternative or combination is more satisfying.

The study aims to determine the location, the typological, functional, economic and operating features of the project and the eligible variants.

The cost estimate is particularly difficult and delicate. On the one hand, it should be based on design assumptions which are still embryonic and then resort to synthetic procedures, but on the other hand it should pursue the most possible accuracy, as the amount of financial resources to be mobilized depending on the cost of construction.

Implementing solutions include, in addition to the above features, the timing of the project that affects the structure of the corresponding financial plan.

The financial resources correspond to the amounts that will be engaged in case of realization of the investment program. These amounts are to be divided into gross and net, that is inclusive or not of revenues, and they should be exposed to the various years of implementation of the program. In relation to the possible variations in design and marketing, corresponding variants of the financial plan should be drawn up.

In relation to the definitions shown and in accordance with the pattern of decision-making, a feasibility study on a real estate investment should be structured according to the following items:

1. Summary;
2. Goals and constraints;
3. Administrative feasibility;
4. Technical feasibility;
5. Analysis of the market (demand);
6. Analysis of the competitive framework (supply);
7. Choice of design features;
8. Estimate of production costs;
9. Estimated time of production;
10. Choice of financing (leverage);
11. Magnitude and timing of revenues;
12. Financial Analysis;
13. Conclusions and recommendations.

The parts from 3 to 11 must propose, in addition to the solutions considered optimal, the analysis and the comparison with the main variants compatible with the objectives.

1. *Summary*. It consists of the usual Executive Summary of all research reports, prepared for the use of the highest decision-making spheres of the client. It should be brief and lacking in detail. The objectives of the clients, the articulation of the study and the main conclusions, which have been reached, are summarized in it.

2. *Goals and constraints.* This chapter identifies the goals of the client. It illustrates the main hypothesis, if there is one, along with variants and alternative hypotheses considered acceptable. The preparation of a plan for real estate development always involves the definition, by the promoter, the specific objectives of the operation and macro-strategies to achieve them. These are typical decisions of corporate strategy that depend on both the financial dimension of the operator, and the type of function which is mainly carried out. Typically, the investor always includes, in the goals to achieve, a minimum acceptable performance in relation to a certain level of risk.

At the same time, together with the definition of the objectives, one proceeds to the completion of an analysis of "pre-feasibility" through the urbanism verification and a first synthetic economic verification.

The pre-feasibility study is a simplified procedure (therefore, less expensive and shorter than the complete feasibility study) where those projects that do not deserve to be subjected to further analysis can be discarded. Consequently, the feasibility analysis should be seen as an ongoing process that becomes progressively more intense as the investor approaches the final decision.

3. *Administrative feasibility*. The first test to be performed is the adequacy of the project with the planning. It aims to ensure all aspects of the approval of the project:

(a) The destinations referred by general or executive planning instruments (current and ongoing);
(b) Constructible areas and/or volumes;
(c) Areas to be divested;
(d) Infrastructure expenses and charges on the cost of construction;
(e) Existing urbanization;
(f) Estimated time needed to obtain the concession.

This verification is extremely simple for small to medium size projects, consistent with the current instrumentation. In these cases, the estimate of the time needed to obtain the concession is not subject to large fluctuations. The situation is very different for larger complex projects, which requires the preparation and approval of urban planning executives that should be concerted in detail with the Public Administration, and when the projects relate to areas included in variations on the general planning instrument or relating to instruments still in progress without final approval. The estimate of the time for the concession is particularly difficult in these cases, even beyond the stage of public consultation between the operator and the private operator. The bureaucratic process unfortunately does not allow any reliable prediction of time, because it is subject to various approval levels and unpredictable events (fall of local or regional governments, the number of practices lying, etc.).

It is obvious that this indeterminacy about the start-up time of an investment, given the weight that has the time variable in the outcome, generally results in a

precautionary approach: a complex operation is considered acceptable if the performance is such that it covers the risk of a significant expansion of the schedule.

The examination of the urban situation involves the preliminary check about when, what and how much is possible to build. If the outcome of this examination shows that, at least at present, on that territory, one cannot build anything, one cannot build what planned, or one cannot build a minimum volume that ensures profitability, then it is useless to achieve the successive phases of the feasibility study. The object of verification may be slightly different when the site is not specifically identified but the potential investor only has a good idea about the profitability of a certain type of real estate investment in a certain area. The subject of the study is then the identification, in that area, of land that may be transformed as expected. In any case, a careful examination of the status and prospects of the relevant urban planning instruments at a supra-municipal, municipal and intra-municipal level, should be carried out.

To ensure the suitability for building of the areas as planned, it is very important to know at what stage the various planning tools are: at the design stage, adoption, approval or if they are fully enforceable. In this way, it is also possible to make predictions about the timing of implementation of the program.

4. *Technical feasibility.* It considers, at a preliminary stage, the compatibility between the physical characteristics of the site (geotechnical parameters, topography, services, etc.) and the alternative uses to which one planned to use for it.
5. *Analysis of the market.* The market analysis is preliminary and essential for any kind of economic initiative. This study is all the more important as the investment initiative is extensive and innovative. As for the analysis of the urban situation, it is appropriate to use a specialist also for market analysis or, a specialized research institute for the more important projects. Market research has already been discussed and the multiplicity of available methodologies has been highlighted. The sources of information and analysis tools are necessarily different depending on the destination of the buildings and thus their potential users (e.g. residential buildings intended for primary residence or for holiday homes, industrial buildings, office spaces, hotels, resorts, etc.).

The market analysis should confirm or refute the assumptions of investors, and in the latter case, advise realignment. If possible, it should also suggest, in the case of complex interventions, the best mix between practicable destinations, provide architects guidance on the building typology on the functional or aesthetic characteristics and give information to the financial experts on maximum prices and forms of payment.

6. *Analysis of the competitive framework* (*Supply*). Other important guidelines are those relating to the competitive scene. It is necessary to estimate the degree of current and future competition in order to determine the current level and the possible evolution of the vacancy rate.

7. *Choice of the characteristics of the project.* If the urbanism and the market investigations provide the expected information, at this point there is enough material to make an initial project proposal. The constructible volume is in fact known, there is the information needed to define the right mix for intended use or size of the individual units and the general standard of quality. Architects can then propose a preliminary design with realistic assumptions about the main structural, architectural and technological elements. These design assumptions should be naturally considered provisional due to the need for further investigation and because this phase should be completed in a relatively short time in order to allow the execution of subsequent phases of the study. The design documentation should be quantitatively and qualitatively adequate for the subsequent estimation of the costs of construction and urbanization.
8. *Estimate of production costs.* The knowledge of the urbanism condition and preliminary design should allow the establishment of a preliminary estimate on the implementing cost of the program. These result from the sum of the costs:

- Acquisition of the area, if not already owned;
- Urbanization, these costs should be estimated with synthetic procedure by analogy with similar projects;
- Construction, always with synthetic procedure, taking into account the cost of any special works;
- Contributions to building permit;
- Charges related to the planning and development process (including the feasibility study, design, construction management, consulting, testing, legal fees, taxes, marketing).

9. *Estimate of production times.* The correct prediction and realistic timeframes of the program is of great importance for a proper assessment of the economic performance of the investment. This provision must be made with the concurrence of all the experts involved in the various sections of the feasibility study. In particular, it is necessary to assess the time required for:

- The eventual approval of planning instruments and the granting of concessions;
- The design;
- The procurements;
- The construction and testing;
- The grant of any administrative licenses.

For each of these phases, the main sub-phases should be suitably highlighted. The full time program can be translated graphically in a Program or Project Evaluation and Review Technique (PERT) or similar chart where the commercialization phase is also placed. In many cases this phase begins even before the end of the construction phase, but it is still important that between the two there is a precise chronology.

10. *Choose the right financing*. The preliminary analysis of the financial feasibility combines the needs of both the investor and the institute who grants the loan. Financing is activated only if the project meets the needs of both parties. As noted above, the loan must be analysed as a function of various possible combinations of equity and capital funded. There are many parameters to consider in order to obtain full control of the loan. Some of the most important are, for example, the interest rate, the amortization period, the costs of start-up and termination of the loan and the impact on taxation.

Firstly, the lender needs to ensure, that the project is able to generate a cash flow that allows for the return of the loan, and secondly, that the most likely selling price of the project is sufficient, should the investor fail to cover the debt if not yet extinct.

11. *Magnitude and timing of revenues.* In view of the cost and time of production previously assessed, it is necessary at this point to estimate the likely revenues, together with their temporal distribution. The amount of revenues over time must be in line with:

- Expected time of sale or lease, possibly distributed over time, when the building initiative covers more than one unit (e.g. apartment or office);
- The temporal development of unit prices in relation to the nominal rate of inflation and the trend of supply and demand;
- The expected payment formulas, particularly with regards to delays and discounts on payment, for example, in the case of a sale in advance done by simply looking at the plans.

In any case, in addition to the most likely scenario considered, it is always advisable to submit less favourable scenarios that define the minimum acceptable condition.

12. *Financial Analysis.* The market analysis provides the data to perform the projection of future cash flows of the project. The cash flow summarizes, in one or more tables, the temporal dynamics and the possible outcome of the investment. For each year, the table shows:

- The production cost, divided into the main items;
- Interest on capital committed, at the current rate;
- Revenues from sales;
- The net balance between revenue and expenditure;
- The total balance at the end of the marketing stage.

With regard to the suggestion above, alternative prospects can be presented corresponding to sub-optimal or minimal conditions. The tables relating to cash flows must be properly commented, recalling the assumptions and the options below to both the main prospect and possible complementary or alternative prospects.

This section of the study should define, with the use of specific techniques, the indices necessary to evaluate the convenience of the investment. The calculations must take into account the risk element.

13. *Conclusions and recommendations.* The final chapter illustrates both the main results of the various phases of the study, and the conclusions summarized in the table relative to cash flows. It distinguishes the evidence provided by the promoters or their experts from those acquired directly. It presents both the results considered most likely and both those considered sub-optimal or minimal. It may include recommendations about certain phases of the investment deemed to be particularly important or sensitive. The clients of a Feasibility Study may be expected to incorporate within it a complementary study aimed at optimizing the economic program. The aim is to maximize or increase the difference between the market value (MV) of the product of the transformation and the cost value of the same (CV). The possible ways to achieve this result are:

- Leave the MV unchanged, but decrease CV;
- Increase MV and leave CV unchanged;
- Decrease MV and, in even greater measure, the CV;
- Increase MV and, to a lesser extent, CV;
- Increase MV and decrease CV.

5.6.3 The Investment Value

The process of the investment property analysis is nothing but an adaptation to this field of capital budgeting techniques used by financial analysts in investment securities. These techniques go through the following key points:

- Estimate of the expected net benefits;
- Chronological adjustment, with respect to timing differences in cash flows resulting from the investment alternatives;
- Quantification of the risks associated with possible alternatives;
- Ranking of alternatives based on the relative risk-return combinations.

The first three elements—the amount of net benefits, their distribution in time and the degree of confidence relative to their occurrence—determine the relative value of investment alternatives. The result of these analyses, therefore, is no more than the estimate of what has been indicated with the term "investment value."

In the previous chapter, the investment value was defined as the estimated value of a property with respect to the specific investor who commissioned the evaluation. Investors are looking to buy only if the value of the investment is higher than the market value of the property, and the owners, on the other hand, are willing to sell the property if they obtain a greater amount than the value they attach to the property as part of their portfolio.

In the light of the concepts introduced in the previous paragraphs, it is therefore possible to define investment value in a form technically more correct. It corresponds to the maximum amount that an investor is willing to pay for the purchase of a property, given the cash flows expected from the management of the property and the minimum rate of return acceptable by the investor himself.

From an operational point of view, the presented scheme requires to make predictions about the future cash flows. Then, to make comparisons between alternatives, it is necessary to adjust and correct the results because they are mutually commensurable incorporating the differences in terms of timing and risk associated with cash flows. Finally, the alternatives are ordered according to their attractiveness (as measured by the risk-yield ratio).

It recognizes, foremost, the need to formulate a prediction on the amount of net benefits that the investment can generate. This step is the most delicate because, despite the amount of data and experience available, unless one does not have gifts of clairvoyance, future events can never be predicted with absolute certainty. Keep in mind that one has to estimate the revenues, operating expenses, the terms of financing, sales prices, the tax burden, the times in which these elements will materialize; each of these entries is a variable of the decision-making process which is be associated with a more or less comprehensive level of certainty (uncertainty).

Easier task operationally is related to the second step of the scheme, namely the chronological alignment of the cash flows. The formulas of financial mathematics must be applied to make comparable benefits and costs that accrue at different times. Of course, even in this case, subjectivity plays a fundamental role: the expectation of profit in fact differs between investors. The investment value depends on the choice of discount rate.

On a specific property, it is possible to evaluate alternative strategies. Holding constant the amount of the loan, the investor can change the other factors and check the result by measuring the value of new investment. The investor chooses the alternative that produces the highest degree of utility per unit of money invested, if all the alternatives have the same degree of perceived risk.

Everyone interprets the information on the basis of personal references, which in turn are the result of personal experiences. For this reason, every individual reaches different conclusions from the same information. It is likely that there is disagreement, for example, about the estimate of the future flow of income from rent and about the operating expenses associated with a property. The fiscal conditions may not be comparable across different investors and because of this; their net revenues may be different even when flows are similar before tax. Investors may also not have the same risk tolerance; furthermore, the preference about the waiver for immediate consumption in order to obtain greater benefits from the same resources in the future may vary between individuals. Those who prefer immediate consumption choose higher discount rates able to reward transactions with a value of short-term recovery than those requiring longer waiting times. In practice, the investment value is different from investor to investor.

References

Adair, A., Berry, J., McGreal, S., Hutchison, N., Watkins, C., & Gibb, K. (2003). Urban regeneration and property investment performance. *Journal of Property Research, 20*(4), 371–386.

Alonso, W. (1964). *Location and land use: Towards a general theory of land rent*. Cambridge: Harvard University Press.

Anderson, R.I., Brastow, R.T., Turnbull, G.K., Waller, B.D. (2013). Seller over-pricing and listing contract length: the effects of endogenous listing contracts on housing markets. *Journal of Real Estate Finance and Economics*, 1–17 (in press).

Ganzach, Y. (1999). *Financial measures of risk and judgments of risk*. Working paper, Tel Aviv University.

MacGegor, D. G., Slovic, P., Berry, M., & Evensky, H. R. (1999). Perception of financial risk: A survey study of advisors and planners. *Journal of financial planning, 12*, 68–80.

Mertz, C. K., Slovic, P., & Purchase, I. F. H. (1998). Judgements of chemical risks: Comparisons among senior managers. *Toxicologists and the Public, Risk Analysis, 18*(4), 391–404.

Slovic, P. (2000). *The perception of risk*. London: Earthscan Publications.

Wingo, L. (1961). *Transportation and urban land*. Washington: Resources for the Future.

Zabel, J. E. (2012). Migration, housing market, and labor market responses to employment shocks. *Journal of Urban Economics, 72*, 267–284.

Chapter 6
Investment Evaluation

Abstract The evaluation of the economic efficiency of investment in real estate, involves the appraisal and comparison of costs and revenues generated from its production and management. In the following paragraphs, the possible approaches to the estimation of cash flows are briefly indicated. On the other hand, this estimate does not exhaust the task of the analyst who should support the investor by setting up a hierarchy of choices identified among a large number of alternatives and accompanied by indices, parameters and risk scenarios. Traditional measures of profitability are analysed for this purpose; however, these have an important limitation: they ignore the effects of the timing of cash flows. Lastly, the discounted cash flow analysis is introduced, and the text describes and explains the main profitability indicators that can be derived from this analysis, highlighting their limitations and strengths.

6.1 Introduction

The verification process for the feasibility of a Real Estate investment refers to the fact that the evaluation occurs in two phases: in the first, where the development hypothesis is defined, an economic verification is made. After this verification there is first a better project definition and then the market researches which are preliminary to the economic and financial final evaluation (second phase).

The evaluation of the efficiency of a generic economic Real Estate investment occurs through a cost-benefit confrontation.

Bear in mind that the efficiency concept used in economy is different to the one used in engineering. In Physics, efficiency is measured through quantity terms and is expressed by the ratio between the amount of goods—or services—and factors used: i.e., a boiler will be considered more efficient than another one, if it produces more heat in equally consumed fuel. On the other hand, economic efficiency has money as a parameter and is measured through the ratio, or the subtraction, between the final value of goods and the cost of the used factors: i.e., there is

B. Manganelli, *Real Estate Investing*, DOI 10.1007/978-3-319-06397-3_6

economic efficiency if the discounted cash value of the allowed fuel savings is higher than the higher price of the new boiler.

The main problem connected to the evaluation of the economic efficiency of a Real Estate investment through cost and benefits confrontation, is that of the monetary terms which determine the benefits. The reason is that a Real Estate investment is normally featured by costs that are close to the evaluation date, while the benefits are more distant in time and, obviously, uncertain. In the cost and benefit evaluation, with reference to the evaluation itself, it is important to focus exclusively on those costs and benefits that directly benefit or support those who have made the investment and ignore those positive or negative effects which are created by the event, but concern other subjects. In fact, if an owner plants trees around the house, there is surely energy saving to be accounted for on the air-conditioning due to less sunlight. However, the same benefit enjoyed by the rest of the neighbourhood cannot be either investigated of quantified.

6.2 Cash Flow Evaluation

The evaluation of the benefits of a Real Estate investment implies, on one hand, the evaluation of the obtainable benefits deriving from Real Estates output (held for sale) or from the administration of these (in this case the final product is the housing service), and on the other hand, the evaluation of the factors regarding production cost.

Therefore, the investor considers land and buildings as factors of production, the cost of which have to be estimated or accounted for with the cost of the other factors, which participate in the economic activity. In the land case, i.e., a permanent and non-destructible economic good, its utilization price corresponds to the interest of the capital used for purchase. Furthermore, as a result of its peculiarity (it is an original good, not increasable in price, therefore permanent) it is not subject to amortization. On the contrary, due to the rent it might increase its value over time. This is something that must be considered during the benefits evaluation phase and especially in the estimate of salvage value. Regarding the building, the utilization price is a compound part of a share of interest on the initial cost and an annual fee of amortization, required to reproduce the same good, or similar, at the end of its useful life. In terms of costs, these are the elements of greater economic commitment, which also involve a specific evaluation strictly connected to the modality of financing. Equally important is the prediction of the costs related to the management of the operation.

Feasibility and convenience of an investment are measured comparing the expenses with the activity benefits flow. Real Estate investment evaluation requires making a prediction—not at all easy—on the performance of many parameters involved in the cash flow calculation. It is fundamental for this purpose to research the operational history of the building (if it is already used) or of other comparable estates. This allows for the identification of the income and

expenditure items related to the management of the property, their volatility and therefore their influence on the profitability of the investment. In relation to the abundance of the information and data, due to marketing researches, it is possible to use statistical-econometric techniques in order to obtain predictions that are more reliable.

6.2.1 Benefits and Future Building Value Evaluation

The active items of a generic cash flow related to a Real Estate investment, considered as variables due to the building type, are usually the rent and the recovery value of the investment at the end of the holding period. The recovery value has to be proportioned to the probable sale value of the building.

For the evaluation of the gross income of a building already in use, it is important to gain information on:

- Agreed rent on a lease;
- The existence of arrears in the payment of rents;
- Volume of vacant spaces.

It is also useful to match these researches with the evaluation of the single leases, which could point out clauses or special contractual forms, concessions and agreements with effects on the rent.

If the acquisition of this information is not possible, an estimate of the potential income is always required in order to verify the accuracy of the data given by the owner and the consistency of that data with the market.

The potential income evaluation, instead, becomes the starting point for a building transformation evaluation (production from scratch or change of use).

Every property expresses a potential income as a function of:

- The interaction of supply and demand in the market area, which sets the level of the rents and the amount of the spaces that can be used;
- Its desirability in relation to the competitive framework.

It has already been shown how the performance of the supply-demand relationship plays a main role in the fluctuation of prices; the market reactions to changes in the economic climate and in particular to changes in some macroeconomic variables, were also analysed. Therefore, it now becomes necessary to collect a variety of data which, if properly interpreted, lead the analyst to formulate a prediction about the possibility and the extent of future changes in the preferences of the specific market. In order to value the potential income, it is also essential to anticipate the changes in the preferences of future tenants about the location and the quality of the real estate.

Furthermore, potential income is directly related to the predictions about the physical and qualitative decay of the building and focuses on questions that involve expenses and the probable recovery of value.

Physical characteristics of buildings are subject to an inevitable natural decay. A direct consequence of this is the decline of the desirability of the property within the competitive framework. This has an inevitable effect on the recovery value. In order to determine such effects, a fundamental parameter needs to be defined: the "Economical life" of the property.

In order to understand this notion it is, first of all, important to distinguish the "economic life of a building" from its "physical life" (duration in efficiency). The latter is strictly bound to the physical deterioration of the building, due to the passing of time. The duration in efficiency of a building, or part of it, is clearly related to the maintenance activities. Regular maintenance and modernization can extend the physical life of a building. Obviously, economic life cannot be longer than physical life. However, unlike the latter, it can be considerably reduced because of a poor compliance of the building, or of one of its components, to new quality standards of the users. This implies an inevitable loss of ranking in market preferences compared to new or retained properties. This phenomenon is called "functional obsolescence". It is caused by technological progress following the built portion of the Estate and has to be separated from the economic obsolescence, which is a factor of economic depreciation connected to variations in the building environment, or rather; it is connected to variations of particular real estate market conditions and of the economy in itself. The economic obsolescence produces a reduction of the land value, thus it is a phenomenon in contrast with the land rent.

The economic life of a building is usually shorter than its physical life. The latter might be estimated comparing similar building types of which the service duration is known because they have already reached their end. Alternatively, it is useful to refer to the physical life of the components that make up the building (Manganelli 2011). Thankfully, the evaluation of the physical life of a building does not show insurmountable problems. More complex is the obsolescence process and consequently, the economic life of the property. The factors that might influence the economic life are surely external to the Estate and might be found, for example, in modernization activities, in the rising standards of quality (functional obsolescence), in the increase of the value of urban land (rent), in socio-economic or environmental changes, in changes in transport and storage techniques (economic obsolescence).

Figure 6.1 displays when an Estate is to be considered economically obsolete, that is at the end of its useful economic life (Csillaghy 1985).

Over time, on one hand the investment value related to the constructed part of the Estate slightly decreases, in fact the physical life decreases and the rent decay becomes higher (maintenance and repairing expenses cause an increase of management costs), on the other hand there is a progressive increase of the land on which the building stands. When the lines that represent these two phenomena meet, the building must be renewed or demolished and replaced.

Figure 6.2 displays a much more detailed interpretation of the phenomenon; it shows that the value of the property is the sum of the values of the land and building. The chart highlights that the increase of the land value compensates and exceeds the effect of the depreciation of the built part. The variation of the value of the building is particularly considered not linear, but with a concave shape, as

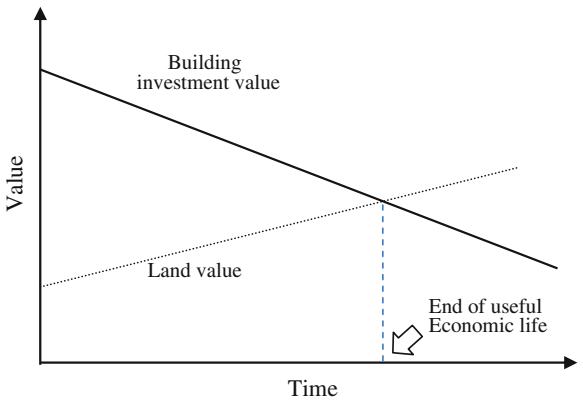


Fig. 6.1 End of the useful economic life of a building

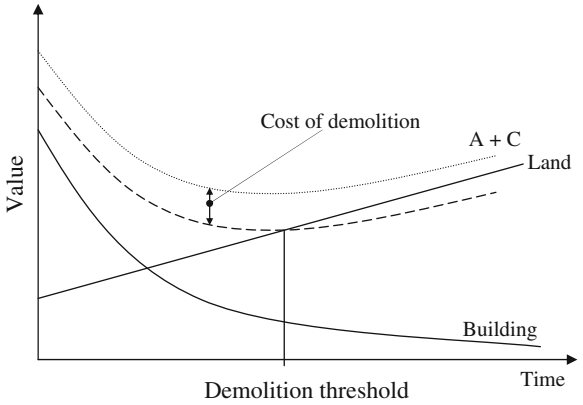


Fig. 6.2 Value curve of an estate, sum of the aliquots related to the area and to the building

shown in several empiric studies (Fisher et al. 2005; Dixon et al. 1999). The intersection between the value curve of the land (increasing) and the curve that describes the total value function (A + C), on which the demolition cost is subtracted, marks the achievement of the demolition threshold, that is the end of its economic life.

An understandable, though only qualitative, representation of the functional obsolescence is represented in Fig. 6.3, the chart shows the relationship between physical life, economic life and service life in relation to the maintenance and upgrading of functional redevelopment on one hand, and the expected increase in quality standards on the other.

The graph is constructed by assuming:

1. That the new building, obviously, has quality and performance levels higher than acceptable standards;
2. Constant growth of this minimum threshold;
3. Slight decay of the considered element.

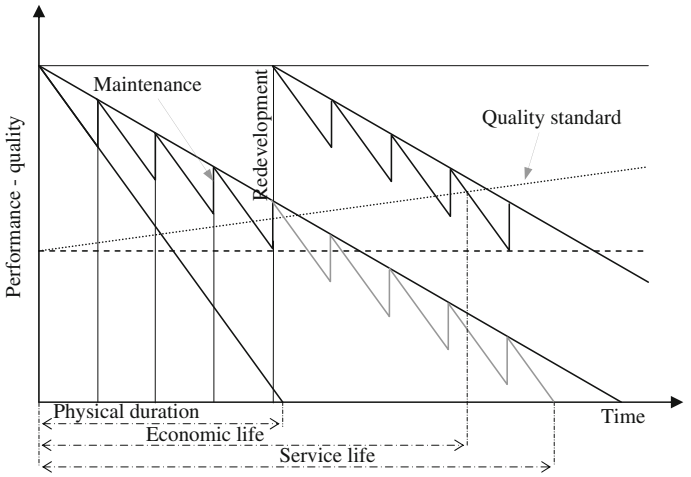


Fig. 6.3 Performance variation related to different possible interventions

All the highlighted factors have effects on the prediction of incoming flows; the effects are therefore reflections of the measurement of the gross income potential, i.e., the evaluation of odds of vacancy (non-vacancy), and uncollectible accounts. These units take into account the loss of income associated with periods of unproductivity and the deducted arrears or insolvency of the tenant, in order to determine the potential Gross Operating Income.

6.2.2 Operating and Management Expenses

Once the Gross Income has been estimated, one must perform an analysis of the parameters that affect the cost of Net Operating Income. Equally important in the cash flow evaluation is the prediction of management costs and estate maintenance. Prediction of future operating expenses is definitely less complicated than the evaluation of gross income: the expenses are less, or not at all, susceptible to those variables that, instead, influence the revenues of the properties significantly. These include the location of the property.

The operating costs of a particular type of Estate may vary, of course, in relation to the different areas of the country, depending on climatic factors and on various economic indices. However, within the same region, there are no appreciable differences between the costs associated with maintaining similar properties.

This means that it is possible to build, by observing the expenses related to various types of Estate (therefore by taking into account the age of the property,

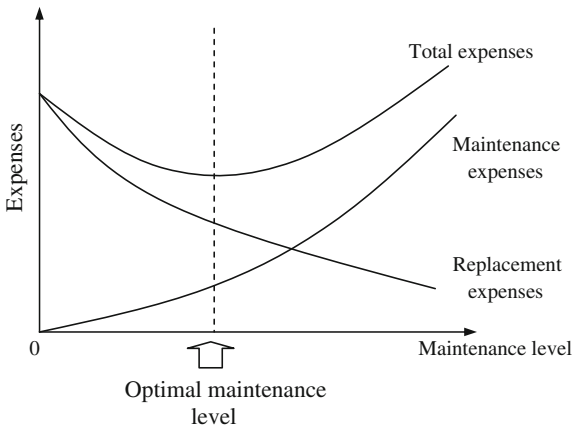


Fig. 6.4 Costs of maintenance and replacement

the quality and use of the construction), a list of expenses divided into geographical areas, thus assisting the analyst in the evaluation process. On the same conditions, the maintenance of an older building is relatively more expensive. Many other parameters may considerably change the amount of the expenses necessary for property management. Please note that in this sense, the design choices regarding the quality of buildings are determinant. The socio-economic characteristics of those who use the rented space are equally important in defining the costs. However, the prediction of time and costs of maintenance and elements replacement and the Facilities management is not easy. The data on the costs of use are not collected in a systematic way and only a few countries have specialized and reliable databases.

These expenses are necessary for Real Estate to guarantee, *ceteris paribus*, that it keeps generating a high enough rent flow.

There is still a compromise problem between maintenance and replacement expenses. In other equal conditions, an increase in maintenance level for single components causes a decrease of its replacement cost per unit of time. A good maintenance extends the useful life of the components of the building. So, generally, the higher the maintenance level (and its costs) the lower the replacement expenses. The optimal level of maintenance corresponds to the minimum of the total cost given by the sum of the costs of maintenance and replacement (Fig. 6.4).

The evaluation of operating expenses has to be developed on the basis of the accounting history of the property under study or, in the case of a new project, by analysing the expenses of similar properties. The reconstruction of the operating history, no matter how complex it is due to the absence of databases, is important as it allows us to develop an estimate of the future costs from certain references.

The costs to be deducted in gross operating income are classified into the following categories:

Table 6.1 Net operating rent for a generic estate

Potential income from rent		A
Vacancy and uncollectable shares		B
		C = (A − B)
Other incomes (i.e., parking)		D
Gross operating income		E = (C + D)
Management expenses		
Management and administration expenses	…	
Services	…	
Insurances	…	
Maintenance	…	
Taxes and duties	…	
Total operating expenses		F
Net operating rent		G = (E − F)

- *Managerial and administrative expenses*: these are expenses related to the tenement management, collection of rents, advertising, record of documents, etc.;
- *Services*: these are the expenses related to custody and caretaking, cleaning and lighting, it is important to check whether these expenses are borne by the lessee (as is usually the case) or the owner;
- *Insurance*: is the full premium that is paid for the risk of fire, lightning, explosions of gas, and to ensure the third party liability;
- *Maintenance*: are the costs incurred for interventions aimed at preventing the deterioration of the property, to ensure the functionality of the use or the extension of the term of efficiency of the building;
- *Taxes and duties*: for this subject, please refer to the next paragraph.

In Table 6.1, the items are the most common actual income and expenses arising from the management of common property.

6.2.3 Recovery Value

Another element of the income flow is the probable sale value of the Estate at the end of the holding period. Although it does not represent an annuity, but a one-off, it forms an important part of the value of investment. The value of recovery certainly depends on all those variables which have been considered in the Gross operating rent prediction, i.e., those that determine the interaction of supply and demand in the market. In predicting future scenarios, one works on the assumption that the Real Estate market works efficiently, free of constraints and bottlenecks so that the rents can be interpreted as return on capital and therefore their evolution

expresses the underlying evolution of the value of the capital from which the return is derived. So, just like any other real or financial activity, when the rent increases (decreases), the value decreases (increases). It would be too risky to imagine different conditions from those, although the reality points out—as shown in previous paragraphs—that because of the proper structural limits of the Rental Market, it does not always express prices/rents that are proxy of the dividend corresponding to the value of the property.

When estimating net operating rent, it is assumed, among other things, that the property will maintain, during the holding period, the same profitability at least for the part of it linked to the technical and functional features of the property. It is also assumed that this capability derives from the appropriate forecasting of the timing (frequency of intervention) and cost of maintenance and upgrading. Given these assumptions, the property will be valued at the end of the holding period, obviously connected to the last estimated income.

The most convenient approach to obtain the final value is to predict the trend of the relationship between net operating income and the market value, and apply this ratio to net operating income for the final year of the investment period. It is a question of estimating the capitalization rate, given by the ratio:

$$r = \frac{Net\ Operating\ Income}{Property\ Value}$$

The capitalization rate varies depending on the cost of capital and on the confidence that investors show in the cash flows from the investment. It is clear that the evaluation is not so easy. Nothing can be said about the future cost of capital; and so, with regards to the expectations of investors, the possible predictions are those reflected in the evaluation of net income flow. Therefore, the assumption of a constant relationship between the fee and the price even at the end of the holding period is reasonable. Having mentioned this, however, a final observation is necessary: the estimate shows that the capitalization rate has to be able to reflect all those variables that contribute to the making up of the property value and that are not already included (at least not totally) in the rent. Among the intrinsic features of the property, one that certainly changes at the end of the holding period and with influence on value but not on rent is the age of the building. The passing of time has effects on the value of the estate, particularly on the building. These effects are distinguishable as consequences of three depreciation factors: sheer age, incoming decay and functional obsolescence. Functional obsolescence has already been discussed. The first two factors, instead, are directly connected to the physical deterioration of the property. The latter is a unique natural event, but it may be useful to break it up in the two mentioned factors, in order to determine the relative depreciation.

Sheer age involves factors of depreciation related to the passing of time and therefore to the fact that the end of the life of the building is coming closer, even if the building and its parts preserve their original performance capabilities (if possible).

Incoming decay is the factor related to the use of the property during time. The wear may compromise the functionality of the Estate, or part of it, causing the decay of its performances. The need to have to ensure efficiency equal to that of a new estate will require a scheduled maintenance or, in the absence of this, extraordinary measures with consistently increasing expenses as the time passes. The effects of the incoming decay are already accounted for in the net rent evaluation, obtained by the deduction, amongst other things, to the gross income, of the maintenance expenses, those expenses capable of ensuring the maintenance of the technical and functional capability of the estate.

The effect of age should be accounted for in the capitalization rate evaluation. In an alternative and certainly more precise way, the loss of estate value due to sheer age is summarised as the accumulation of payback shares corresponding to the value of the building in the range corresponding to the holding period.

If C_o is the cost of construction of a new building (if new) or its cost of reconstruction depreciated to the initial year (if used),[1] m is its remaining useful life and i is the interest rate, the share of re-integration is given by:

$$Q_{reint} = C_o \times \frac{i}{(1+i)^m - 1}$$

Although this amount does not correspond to an actual outlay, and therefore not included in the item to be deducted in the gross operating income, it must be financially counted in the cash flows. This allows:

- To measure the depreciation in the value of the property which is subject to capital investment through the capitalization of net income[2];
- To estimate the depreciation caused by immobility due to sheer age at the end of the holding period;
- To achieve these goals and avoid having to consider equivalent corrections to the rate of capitalization; these latter operations, however, could provide much more uncertainty.

6.2.4 Financing Management

If the investor decides to use a loan to partially finance the purchase of a property, then the contents of Table 6.1 have to be modified by adding "annual instalment of debt amortization". This will be subtracted from the Net Operating Income to

[1] At a cost estimated in this manner, for greater accuracy, it should be summed to the cost of demolition and waste transport for disposal of the building to be replaced at the end of its useful life.

[2] Land is an original and permanent source, and everything built on it has a limited life in efficiency and is therefore subject to amortization.

determine the annual cash flow before taxes. Net Operating Income means the difference between incomes and expenses of current management before financial charges and tax:

Net operating income	G
Annual instalment of debt amortization	H
Cash flow before taxes	G − H

As a matter of fact, the convenience is to be assessed from the point of view of the specific investor, by incorporating the consequences of the application for funding in the evaluation. External financing is nearly compulsory due to the large amount of capital necessary for the transfer of real estate. The tools needed to guide the choice for the most affordable financing have already been discussed.

6.2.5 Evaluation of Construction Costs

To assess the possibility of a profit from the implementation of a project it is necessary, firstly, to determine the nature and extent of the expected incomes, and finally to predict, in the amounts and time, the outflow of capital. For those investments that contemplate the transformation of estates (e.g., the construction of new buildings or renovation of existing buildings), the evaluation of the cost of the transformation with the cost of management plays an important role in taking the right decision for investment. In this sense, the estimate of the cost of the investment and the prediction of how costs will be distributed over time is crucial. Regardless of the characteristics of the project and the type of client, this information is invaluable for taking a decision on how to finance the operation. Just the considerations and patterns that can lead to the final choice may vary.

This phase of the assessment is based on the concept of 'cost value', and on the procedures for its determination.[3]

Every survey of the costs must always be in view with a wide range of factors: the quality and quantity of the projected works, the purchase price of the inputs; any other fees associated with the building production.

The preliminary analysis of costs is carried out at different times of the development of a construction project. As one moves to the next stages of completion and implementation of the project, one must modify or adapt the procedures for assessing the cost of construction in order to improve the forecasting ability and consequently allow the optimization of the design choices. The main and fundamental objectives that must be pursued prior to the estimate of the cost are:

- Facilitating the comparison of alternative solutions;
- The definition of the allocation;

[3] For more details, see Manganelli (2011).

Table 6.2 Cost item in construction activity

Cost	Promotion costs	Identification and feasibility studies, project evaluation
	Production costs	Acquisition and preparation of the areas, construction of the planned work; profit due to the organizer of the construction process; rate of use of capital employed (interest expense); surveys and geotechnical investigations, preparation of preliminary and final design, the definition of any other elaborate for the start of the procedure for the award of work, testing of works and supplies (technical costs), other expenses associated with the construction (urbanization, contributions concession etc.)
	Management and maintenance costs	Works and services to be performed in order to ensure the use of the finished work (cost of operation) and to keep the original features of the building for as long as possible (ordinary and extraordinary maintenance costs)
	Redevelopment costs	Works and services to be made to counter, from a certain point in the cycle of life, functional and economic obsolescence of the work (costs of technological upgrading, restoration, renovation, demolition and reconstruction)

- Continuous monitoring of the budget constraint;
- An indication of an objective parameter around which to develop the negotiation for the award of the work;
- The identification of the most likely invested cost or minimum price in the submission of tenders.

The estimate of the likely cost of construction is obviously preceded by the identification of the fundamental characteristics of the transformation. This is done with greater or lesser detail depending on the stage of development of the design.

The evaluation of a construction cost, in relation to the purpose and to the demanding subject can be performed to determine a generally valid result or aimed at an assessment of cost effectiveness. A public promoter is interested in order to identify the conditions that lead to the formation of prices in a contract. In this case the cost evaluation must be objective and generally valid. The companies and promoters must verify the conclusions they have reached and thus reproduce the assessment in view of the individual and specific ability, risk appetite and the needs of profit.

The task of the performer of the estimate is to identify the physical elements of a project that will have a greater economic significance, measure and evaluate the quantity, the price declines as a function of the client and his objectives, and finally bringing them together in a single figure called cost value.

The total cost can be divided into the categories shown in Table 6.2.

In the early stages of the preparation of a construction project, all of these cost elements should be evaluated with the use of procedures that can provide a reasonable, although not perfect result, which gives idea of the financial commitment required by the project. Only later, thanks to a better definition of quantitative and qualitative characteristics of the project, it will be possible to use more sophisticated evaluation procedures.

6.3 Traditional Techniques for the Analysis of Profitability

The analyst's task does not end with the formulation of a cash flow forecast and the collection of the necessary information to take the investment decision. He must support the investor setting up a hierarchy of possible choices identified among a large number of policy alternatives accompanied by economic indices, parameters, and risk scenarios.

The calculation of the profitability measures respond to this need by representing, in many ways, the relationship between the amount of invested money and the expected returns. The techniques used for the calculation of these indicators may differ for the use of the available data, and in terms of how to consider (or ignore) the different levels of risk.

This chapter analyses the virtues and weaknesses of the traditional criteria for the evaluation of profitability. Simple indicators of convenience, almost always specify the form of the relationship between prices and revenues. In most cases, for the determination of these indices it is not necessary to provide preventive analysis of expected cash flows.

6.3.1 Advantage Reports

These reports are used to quickly judge (*Rules of Thumb*) the reasonableness of the relationships between measures of value and performance. In this category, it is possible to recognize two types of indexes:

- Financial measures or reports;
- Performance/Profitability measures of reports.

Financial reports consider the relationship between incomes and operating expenses, whereas the efficiency ratios express the relationship between net operating income and value. They are very simple measures that do not constitute an exhaustive tool for analysis, but allow us to quickly filter the unacceptable investment opportunities. The more sophisticated analysis (and of course the more expensive) will be able to focus on the most promising alternatives.

While the calculation of the indices is an elementary process (it involves the simple division between two variables), their interpretation (ratio analysis) is more complex. First, the index must have an economic meaning, i.e., it must compare two quantities with an underlying logic, and secondly the interpretation of the indexes must consider the factors that affect the same variables that are used in the report. Even when analysing the indexes used for the selection among the various possibilities, the criteria for interpreting general comparison with those that characterize similar properties are valid. Thus, the study of financial or profitability reports must be preceded by the determination of relations prevailing in the market.

Table 6.3 Financial reports for estimating the reliability of the estimated flows

$Operating\ Report = \frac{Operating\ Outgoings}{Gross\ Effective\ Income}$
$\frac{Outgoing}{Revenues} Ratio = \frac{Operating\ Outgoings + Debt\ Installmet\ Payment}{Gross\ Effective\ Income}$
$Debt\ Recovery\ Ratio = \frac{Net\ Operating\ Rent}{Debt\ Installmet\ Payment}$

6.3.2 Financial Measures

Table 6.3 shows some possible financial ratio.

The calculation of these indices may reveal anomalies in expected cash flows. Their use requires, of course, the availability of data with which to make the comparison within the market. Their usefulness is noticeable even when, in the first stage of the analysis, one has the need to rapidly eliminate less attractive investment alternatives and then to concentrate the investigations on the most interesting possibilities.

A good investment strategy contemplates the property search, characterized by very low operating ratios. The operating ratio is a measure that can be misleading because it also affects the efficiency of the administration.

The cost-benefit ratio and the debt coverage ratio give a safety measure associated with the use of funding. Particularly, the debt coverage ratio (Debt Service Cover Ratio) is used to determine the bankability of the project. Bankability is a term usually used to define the acceptability of the whole banking sector, the overall structure of a project for the purposes of its funding. It indicates the possibility for an initiative to be financed with a certain financial structure, which therefore provides a corresponding allocation of risk.[4] This indicator should be calculated for each year of the duration of the project or the financing. This indicator is properly called Annual Debt Service Cover Ratio (*ADSCR*), corresponding to the ratio between the net operating income relative to a given year and the corresponding debt service *Dt* (calculated as the sum of principal and interest) in the same year.

$$ADSCR_t = \frac{Net\ Operating\ Income_t}{D_t}$$

Another useful indicator to determine the financial feasibility of the project is the Life Loan Debt Service Cover Ratio (*LLDSCR*). It is defined by the quotient of the sum of the discounted cash flows available for debt coverage (net operating

[4] It can occur that an investment project, that is characterized by a positive Net Present Value (NPV concept is illustrated in the following paragraphs), cannot be bankable, because during a generic life-span of the investment itself, it does not find adequate funding.

incomes)—included between the time of evaluation and the last year allowed for repayment of the loans—and the remaining debt considered at the same moment of the evaluation.

$$LLDSCR = \frac{\frac{\sum_{t=s}^{s+n} Net\ Operating\ Income}{(1+r)^t}}{D_s}$$

with

s	the time of evaluation;
$s + n$	the last year for which the proposed debt repayment;
D_s	the outstanding debt at the time of evaluation.

The numerator of the ratio is, therefore, the present value of cash flows generated by the project on which the lenders can rely on for the future return of the amounts still owed.

Indices greater than one indicate a greater financial security for investment and a greater guarantee of repayment to lenders.

Example 6.1 Through interviews with tenants, one becomes aware of the fact that some of them enjoy special concessions handed out by the owner, not mentioned in the leases. To check the reliability of the cash flow of the property in question, one passes to the analysis of the data of four comparable properties in the immediate neighbourhood. The characteristics of these buildings are similar to those of the object properties of interest.

Property A—25 units divided as:

- n. 17 apartments of 85 m^2 with 2 bedrooms leased at €480 per month;
- n. 5 apartments of 60 m^2 with a room leased at €330 per month;
- n. 3 offices of 45 m^2 rented for €250 per month.

Currently, an apartment of 85 m^2 is vacant.
Property B—19 units divided as:

- n. 7 apartments of 85 m^2 with two bedrooms rented for €500 per month;
- n. 8 apartments of 60 m^2 with a room in Holiday sold for €350 per month;
- n. 4 offices 47 m^2 leased for €260 per month.

Currently, vacancy rates are a flat of 60 m^2 and a study.
Property C—36 units divided as:

- n. 22 apartments of 80 m^2 with 2 bedrooms rented for €460 per month;
- n. 8 apartments of 58 m^2 with a rented room at €330 per month;
- n. 6 offices of 45 m^2 leased at a monthly fee of €240.

Currently, there are 2 vacant apartments of 80 m^2 and a study.
Property D—30 units divided as:

Table 6.4 Comparison of rents

	Comparable properties			
	A	B	C	D
Apartments with 2 bedrooms				
Monthly rent	€480	€500	€460	€485
Area (m^2)	85	85	80	83
Rent per square meter	€5.64	€5.88	€5.75	€5.84
Apartments with 1 bedrooms				
Monthly rent	€330	€350	€330	€335
Area (m^2)	60	60	58	60
Rent per square meter	€5.5	€5.83	€5.69	€5.58
Offices				
Monthly rent	€250	€260	€240	€265
Area (m^2)	45	47	45	51
Rent per square meter	€5.55	€5.53	€5.33	€5.19

- n. 10 apartments of 83 m^2 with two bedrooms rented for €485 per month;
- n. 13 apartments of 60 m^2 with a room rented for €335 per month;
- n. 7 offices of 51 m^2 leased for €265 per month.

A study and an apartment of 60 m^2 are not leased.

The data collected in Tables 6.4 and 6.5 sets the comparison between the four units of reference.

Table 6.4 shows that the units with 2 bedrooms make an average of €5.76 per square meter; the apartments with one room can be rented at €5.66 per unit area, while the offices are sold at about €5.40 per square meter.

Table 6.5 compares the vacancy rates of comparable properties. Note that case B has a relatively high vacancy rate with regards to the apartments with one room and offices. This can be attributed to temporary problems (malfunctioning of the systems, evictions, etc.), or to the mismanagement of the property.

Using the average data collected in the previous tables, and relying on the management skills of those who will administer the property being analysed, one can build an approximate "evaluation" of the gross income derivable from the building in question (Table 6.6).

The data in Tables 6.4 and 6.5 and therefore the synthesis carried out in Table 6.7 are a reference to test the correctness of the data provided by the owner of the estate one intends to purchase and/or to correct any inconsistencies. The comparison with similar buildings that fall into the same category is also crucial in estimating the amount of individual elements of expenditure management. The survey, in the example, shows that a reasonable program of maintenance and repair can absorb between 11 and 12 %

Table 6.5 Comparison of vacancy rates

	Comparable properties				
	A	B	C	D	Total (average)
Apartments with 2 bedrooms					
Number of units	17	7	22	10	56
Vacant units	1	0	2	0	3
Vacancy rate	5.8 %	0	9 %	0	(5.3 %)
Apartments with 1 bedroom					
Number of units	5	8	8	13	34
Vacant units	0	1	0	1	2
Vacancy rate	0	12.5 %	0	7.7 %	(5.9 %)
Offices					
Number of units	3	4	6	7	20
vacant units	0	1	1	1	3
Vacancy rate	0	25 %	16.6 %	14.2 %	(15 %)

of gross income. The situation is similar relating to property taxes. This series of comparisons and controls allows to build a picture about the likely profitability of the property of interest (Table 6.7).

What one gets is a "correct" cash flow, a reconstruction of the operating history of the Estate that outlines a good guide for predicting the immediate future. In the absence of changes—always possible—in the building or in the economic context, there is no reason to expect a substantial change in the amount of operating expenses. The possibility of different and unpredictable scenarios involves risk assessment.

The analysis of the market, of supply and demand, of its main components and the macro and micro economic indicators, however, allow to push the prediction over a short horizon, starting right from "correct" cash flow.

In the example, the assumption is that because of the high vacancy rates and stagnant rents, the last three years are characterized by an arrest in construction market. However, the same three-year period showed a linear decrease of the vacant spaces where the percentage increased from 14 to 7 %.

This has led to, over the past six months, a slight increase in the level of rents. It is expected, therefore, that the property in question will be affected by the new conditions of the market and it is probable an increase in rents. Assuming also that the maturities of leases are not contemporary, the adjustment of the total income to changes in market prices, although it occurs year after year, involves the expectation of a certain number of years for a perfect alignment.

The real estate property is in a residential neighbourhood close to the area where some of the offices and work activities of the city are, so a further

Table 6.6 Estimated gross potential income and vacancy rate

	Type of housing units		
	Two rooms	One room	Office
Potential gross income			
Fee per square meter	€5.76	€5.66	€5.40
Area (m^2)	×90	×65	×45
Rental of the individual units	€518	€368	€243
Number of units	×5	×15	×8
Potential monthly income	€2,590	€5,520	€1,944
Annual (monthly × 12)	€31,080	€66,240	€23,328
Vacancy			
Potential annual income	€31,080	€66,240	€23,328
Vacancy rate (Table 6.5)	×0.053	×0.059	×0.15
Vacancy losses	€1,647	€3,908	€3,500
Total potential gross income = 120,648 € Estimated losses for vacancy = 9,055 €			

Table 6.7 Cash flow of an apartment building

Potential gross income		€120,648
Losses for vacancy		€−9,055
		€111,593
Rental car parking		€7,500
Effective gross income		€119,093
Expenses		
Operating expenses (5 % EGI)	€5,950	
Wages	€10,000	
Various	€10,000	
Insurance	€5,000	
Supplies	€1,500	
Advertise	€600	
Maintenance and repairs	€13,000	
Property taxes	€15,000	€−61,050
Annual net income		€58,043

decline in the vacancy rate and a corresponding annual growth in rents is expected. This at least until the vacancy rate exceeds, downward, those levels considered as normal, so as to induce new real estate development initiatives. At that point, the vacancy rates will rise again at the physiological

Table 6.8 Expected cash flow for the next 6 years

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Potential gross income (€)	121,421	125,306	129,316	131,902	134,540	137,231
Losses due to vacancy (€)	−8,421	−5,012	−5,172	−7,914	−8,072	−8,232
Rental car parking (€)	8,000	8,420	8,690	8,679	8,852	9,030
Gross operating income (€)	121,000	128,714	132,834	132,667	135,320	138,029
Expenses						
Administration (€)	6,050	6,436	6,642	6,633	6,766	6,901
Managerial charger (€)	10,300	10,506	10,716	10,930	11,149	11,372
Supplies/services (€)	10,300	10,506	10,716	10,930	11,149	11,372
Insurance (€)	5,150	5,253	5,358	5,465	5,574	5,686
Various (€)	1,545	1,576	1,607	1,639	1,672	1,705
Advertising (€)	618	630	643	656	669	682
Maintenance (€)	13,390	13,658	13,931	14,209	14,493	14,783
Taxes (€)	15,000	15,000	15,000	15,000	15,000	16,050
Total expenses (€)	62,353	63,565	64,613	65,462	66,472	68,551
Annual net income (€)	58,647	65,149	68,221	67,205	68,848	69,478

Table 6.9 Ratio operating expenses/expected effective gross income

Years	1	2	3	4	5	6
Ratio	0.515	0.494	0.486	0.493	0.491	0.497

level. This scenario is reflected in the prediction of a flow that already in the third year marks a slowdown in the rate of income growth that tends to settle on measures of expected inflation (e.g., 2 %). Other revenues, those resulting from renting parking spaces, remain constant in per cent of revenues from leases of housing.

Based on the operating history of the same property and those comparable, it is conceivable an increase in operating expenses, which the number of tenants not affect. From these charges are, however, excluded the administration expenses and taxes. For the latter, it is suggested that it will be unchanged their impact on the effective gross income. These assumptions and expectations are therefore reflected in the prediction of cash flows for the next six years, reported in Table 6.8.

To test the feasibility of the predictions, it is useful to calculate the ratio between operating expenses and expenses actual gross income. This index is calculated for each year of the forecast and is presented in Table 6.9. Its performance should be compared with what one gets by extrapolating the

historical values of this parameter, where available publications containing this type of information.

The stability of the measured ratio legitimate estimate of property market value at the end of the sixth year (holding period), applying to the net income the average capitalization rate calculated by reference to similar properties in the same market area.

Assuming that the analyst identifies an average rate of 6 %, the market value (recovery value) provided at the end of the investment period will be approximately:

$$V_r = \frac{69{,}478€}{0.06} = 1{,}157{,}967€$$

It is still assumed that the investor has decided to use, for the purchase, a mortgage loan to amortize over 20 years with equal monthly instalments. The interest rate is 8 %. The investor and the bank agreed to a loan-to-value ratio of 70 % and a debt coverage ratio of not less than 1.2. The amount loaned is therefore bound to the more restrictive conditions laid down by these two parameters.

The analyst estimates the current value of the property in about €560,000. This means that the institution will not grant a loan of more than $0.7 \times$ €560,000 = €392,000.

The rate of amortization of the debt will not exceed €58,647/1.2 = €48,872. The maximum available amount in relation to this parameter is

$$€48{,}872 \times \frac{(1+0.08)^{20}-1}{0.08 \times (1+0.08)^{20}} = €480{,}000$$

The condition is more binding than that established by the loan-to-value ratio, so the amount at disposal for the investor is €392,000.

This means that the investor must include in the expected cash flows an instalment of the annual depreciation of €39,346.12.

$$\textit{Monthly Installment} = €392{,}000 \times \frac{\frac{0.08}{12} \times \left(1+\frac{0.08}{12}\right)^{12\times 20}}{\left(1+\frac{0.08}{12}\right)^{12\times 20}-1} = €3{,}278.84$$

$$\textit{Annual Installment} = 12 \times €13{,}278.85 = €39{,}346.16$$

Table 6.10 Cash flow expected over the next six years, in the case of financing

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Potential gross income (€)	121,421	125,306	129,316	131,902	134,540	137,231
Losses due to vacancy (€)	−8,421	−5,012	−5,172	−7,914	−8,072	−8,232
Rental car parking (€)	8,000	8,420	8,690	8,679	8,852	9,030
Effective gross income (€)	121,000	128,714	132,834	132,667	135,320	138,029
Expenses						
Administration (€)	6,050	6,436	6,642	6,633	6,766	6,901
Managerial charges (€)	10,300	10,506	10,716	10,930	11,149	11,372
Supplies (€)	10,300	10,506	10,716	10,930	11,149	11,372
Insurance (€)	5,150	5,253	5,358	5,465	5,574	5,686
Various (€)	1,545	1,576	1,607	1,639	1,672	1,705
Advertising (€)	618	630	643	656	669	682
Maintenance (€)	13,390	13,658	13,931	14,209	14,493	14,783
Taxes (€)	15,000	15,000	15,000	15,000	15,000	16,050
Total expenses (€)	62,353	63,565	64,613	65,462	66,472	68,551
Debt amortization instalment (€)	39,346	39,346	39,346	39,346	39,346	39,346
Cash flow before tax (€)	19,301	25,803	28,875	27,859	29,502	30,133

Table 6.11 Indicators of reliability of the estimated flows

$Revenue\ Cost\ Ratio = \dfrac{Operating\ Exepenses + Debt\ Payment\ Installment}{Effective\ Gross\ Income} = 84\,\%$
$Debt\ Coverage\ Index = \dfrac{Operating\ Net\ Rent}{Debt\ Payment\ Installment} = 1.49$

Table 6.10 shows the projected cash flow for the next six years in the case of financing, and finally in Table 6.11 other two financial reports are calculated.

6.3.3 Measures of Profitability

The characteristic of the traditional measures of affordability is to find a systematic relationship between capital investment and expected returns. The techniques differ depending on the way the available data are processed.

6.3.3.1 Return on Investment

It is given by the ratio between the net operating income and the price of property (the cost of investment):

$$ROI = \frac{Net\ Operating\ Income}{Net\ Invested\ Capital}$$

The Net Invested Capital, in the case of real estate investment, coincides with the property value, net of amortization and provisions. This index allows us to evaluate profitability in current management, as it excludes both the results of extraordinary administration (sales, active one-off, etc.) and financial aspects (level of indebtedness, finance charges, etc.). This last feature, however, represents one of the major limitations of ROI analysis which may in fact be crucial to assess the suitability of investments in relation to different funding opportunities.

6.3.3.2 Return on Equity

Return on equity (ROE) incorporates the effect of external financing; it measures the ratio between cash flow before tax and the amount of money paid by the investor:

$$\begin{aligned} ROE &= \frac{Cash\ Flow_{BT}}{Equity} \\ &= \frac{Net\ Operating\ Income - Debt\ Amortization\ Installment}{Investment\ Capital - Available\ Financing} \end{aligned}$$

It measures the return on equity, identified as the ratio between net income and shareholders' equity. ROE therefore varies according to the financial burden.

The level of indebtedness is crucial in the relationship between ROI and ROE: growing debt spreads the difference between the two indexes. If the return on investment is higher than the interest rate on the debt, the return on equity increases with the debt ratio. Both in the ROI that in the ROE, the cash flows are net of taxes. So, these two indicators can reasonably be used only to compare investment opportunities characterized by a tax similar.

One way to improve these measures is to try to take account taxation. Replacing the Before-Tax Cash Flow with the flow get flow adjusted for tax due from the specific investor (After-Tax Cash Flow), is obtained an index that takes into account the different effects of taxation:

$$ROE_{AT} = \frac{Cash\ Flow_{AT}}{Equity}$$

6.3.3.3 Payback Period

Another extensively used index is the so-called payback period (PP), which is the evaluation of the number of years required to recover the capital invested in the project. When the cash flow expected from an investment remains constant over the years, then this parameter is obtained by dividing the amount of money invested by the contractor to the annual cash flow:

$$Payback\ Period = \frac{Equity}{Annual\ Cash\ Flow}$$

When the cash flows are never the same from one year to another, the calculation is slightly more complicated, so the system most commonly used to calculate the PP consists of progressively adding the expected annual flows and comparing the accumulated sum at the end of each year with the initial investment.

Normally, the flows are discounted to the current period, and in this case the Discounted Payback Period (DPP) is used. This introduces another problem: that is, the choice of the discount rate which will be dealt with in the next few paragraphs. If the flows are simply summed, then one speaks of Simple Payback Method (SPM). *Ceteris paribus*, the investment that has the shortest payback period is more convenient. However, a shorter payback period does not necessarily indicate a high level of economic efficiency. An investment that has a longer payback than an alternative investment, may be more convenient if it produces (positive) flows for a longer period.

Simple Payback Method measures the time (usually in years) between the date of the initial investment and the one in which the sum of the expected cash flows resulting from the investment equals the investment itself.

This is the minimum value that satisfies the equation:

$$\sum_{t=1}^{Y}(B_t - C_t) = C_o,$$

where

Y	number of years to ensure that the income of the operation equals the initial investment;
B_t	monetary value of benefits (income, savings, cost reduction, etc.) to year t;
C_t	monetary value of costs (maintenance, operation, replacement, etc.) to year t;
$B_t - C_t$	net income in year t;
C_o	monetary value of the initial investment.

Table 6.12 Example of calculation of the SRT

Years	Cash flows (€)	
	Annuals	Cumulative
1	7,200	7,200
2	8,300	15,500
3	9,500	25,000
4	10,700	35,700
5	12,000	47,700
6	13,100	60,800
7	14,250	75,050

Example 6.2 A property can be purchased with an initial investment of €50,000. Cash flows after tax are shown in Table 6.12.

The data indicate that the initial outlay will be recovered during the sixth year. Therefore, the Payback Period (SPM) is 6 years.

6.3.4 The Limits of the Traditional Criteria of Profitability

To understand the limitations of the performance measures of the investments described so far, just remember the most important components of the expected return and observe that many of them are not brought into account in measuring the reports on traditional profitability. For the commitment of capitals, the investor expects to receive an operating cash flow during the period of investment but also a final income thanks to the disinvestment. The convenience of an investment is governed by the following factors:

1. The amount and timing of the commitment of capital;
2. The amount and timing of expected future cash flows;
3. The degree of (subjective) confidence that characterizes the expectations;
4. The investor's attitude to risk.

Subsequently, the relevant question concerns the change in the projections of the expected cash flows on the basis of the strategies and nature of the specific investor. These adjustments must be related to the quantity, quality and timing of cash flows.

An ideal measure of profitability should incorporate each of the listed factors. The most important limitation of the analysed criteria in this section is that to ignore the effects of the timing of cash flows. For this reason, the indicators presented so far represent only the instruments for more sophisticated analysis

based on measurements that take into account the time factor. Remember that the analysis conducted through the indexes is complementary to flows analysis.

The techniques described in the next paragraph are all "time-adjusted" types, as serving at the time of the assessment of future cash flows. Some techniques perform corrections just in order of temporal homogenization of cash flows, others also include adjustments related to the risk of the investment.

Finally, it is worth remembering that there is no absolute indicator of profitability: only the economic operator, knowing the characteristics of the investment, is able to decide the type of economic and financial analysis and indicators that can best support the final decision. For example, a real estate promoter whose main activity is the building industry, who promotes real estate investment and therefore carries them out directly, will surely be interested in both a prior analysis of a single real estate transaction to be developed and an analysis of the financial statements in order to assess the industrial enterprise management.

6.4 Modern Techniques for the Analysis of Profitability

Despite their differences, the procedures to be used for the measurement of "time adjusted" profitability indicators need to be based on some common recruitment or assumptions. They are, for example, those concerning the time horizon of the analysis, the discount rate, the residual value, etc. If not supplied by the client, the corresponding data should be identified, selected, estimated or defined by the evaluator. The same parameters will of course apply to all alternative solutions.

6.4.1 Introduction to Discounted Cash-Flow Analysis

According to modern investment analysis, a proposal is acceptable as long as its return rate is higher than the marginal cost of capital committed. In this sense, the technique to be used in the evaluation of investments cannot fail to consider the time, factor which essentially the cost of capital depends on. The main assumption of financial theory is, precisely, the allocation of a financial value to the time.

The most commonly used technique for evaluation is therefore the Discounted Cash-Flow Analysis (DCF). The choice of this technique, accompanied by its main profitability indicators, is based on the notion that, in the preventive stage and in the case of real estate investments, these indicators are more effective in supporting decisions compared to others that may be more useful in the analysis of management and budget. The techniques described in the previous paragraph, and the indicators defined as elementary, arising from them, do not take into account the evolution of the cash inflows (revenue or income) and negative flows (outputs or costs) over time. The current available technology and the huge increase in the possibilities of calculation resulted in the replacement of these basic indicators

(Rules of Thumb) with technical analysis—it is precisely the DCF—able to analyse the time evolution of alternative scenarios.

In a more general framework, the analysis of investment through the criteria of cash flows falls within the aim of economic evaluations aimed at investigating the net present value of an investment, even public. The discount cash flow is at the basis of Cost Benefit Analysis (CBA) of an investment project. In its simplest form the analysis of cash flows consists of a monetary evaluation, that does not take into account the social effects. In this sense, the perspective is strictly private. On the other hand, the investor, in general and therefore in real estate, has as his main goal, the maximization of profit.

The evaluation of the profitability analysis of the cash flows is based on the determination of the present value or of the financial sum of flows (revenues minus costs) discounted at the initial time and generated directly from the investment and in favour or disfavour of those who make it. This is the case of the Revenue and Cost Analysis (RCA).

6.4.2 The Net Present Value

The increase of wealth which is initially estimated, and which the operator makes through investment, is defined as net present value (NPV). The NPV is a key indicator of the profitability of the investment and represents the sum of the present values of the incoming and outgoing individual cash flows.

The general formula that describes the NPV is as follows:

$$\text{NPV} = \sum_{t=0}^{N} \frac{CF_t}{(1+r)^t}$$

where

N number of periods, investment time horizon or period of analysis;
CF_t expected cash flows;
r discount rate (minimum acceptable rate of return).

If, as in the case of investment property, the initial capital investment—the purchase price—at year zero is CI, the Net Present Value can also be determined as:

$$\text{NPV} = \sum_{t=1}^{N} \frac{CF_t}{(1+r)^t} - CI$$

If the current value is greater than the initial invested amount, it means that the expected return is higher than the rate used for discounting. If the latter coincides with the minimum acceptable return, it means that the investment project deserves

Table 6.13 Expected cash flows

Years (t)	Expected cash flows (€) (CF_t)	Present value (€) ($CF_t/(1 + i)^t$)
1	13,500	12,272
2	14,000	11,570
3	14,600	10,969
4	15,000	10,245
5	16,000	9,934
6	16,200	9,144
7	16,500	8,467
8	16,500 + 50,000	31,022
	Total	103,623

to be considered. A positive NPV indicates that the return on investment will exceed the minimum amount acceptable. An NPV less than zero means, however, that the project does not meet the expectations of gain.

The cash flow CF, used for the evaluation of economic feasibility of an investment should be calculated as such:

- *Monetary*, or it must involve an actual entry or exit of cash;
- *Differential*, closely related to the project.

In the analysis of cash flows, monetary flows are represented by the difference, each time, between revenues (rental or sales) and the cost of construction and management (in the case of rent). The flows may be considered net and /or gross of both the financial burden and of taxes.

In a context of certainty, where the cash flows are not subject to any risk about their actual occurrence in terms of quantity and time, the problem remains in the choice of discount rate. Thus, the NPV will take as many values as are the discount rates used or usable for the specific investment.

As said, the profitability of an investment is to be considered acceptable if the NPV is positive, that is when revenues exceed costs, both of them discounted.

Example 6.3 Consider the possibility of investing in a property of which expected cash flows for the next 8 years are listed in Table 6.13. From the disinvestment, expected by the end of the eighth year one expects to earn €50,000. The purchase of the Estate involves an outlay of €95,000 and the investor has fixed the minimum rate of return of 10 %.

One gets an NPV = €103,623 = €−95,000 + €8,623, which is greater than zero. This indicates that, according to forecasts, the investment makes it more than the minimum acceptable rate.

6.4.3 The Internal Rate of Return

The problem of choosing the rate may be bypassed, but just apparently, by using another indicator of profitability: the IRR, Internal Rate of Return. The IRR is the discount rate that makes the net present value of all cash flows (both positive and negative) equal to zero. It can also be defined as the discount rate that equalises the positive and negative flows for a particular investment.

Specifically, the IRR is obtained by zeroing the NPV and solving the above equation with respect to the rate (r).

$$\text{NPV } (r) = \sum_{t=0}^{N} \frac{CF_t}{(1 + IRR)^t} = 0$$

or

$$\text{NPV } (r) = \sum_{t=1}^{N} \frac{CF_t}{(1 + IRR)^t} - CI = 0$$

The IRR measures the return on invested capital. This solution on its own, however, does not indicate whether it is convenient to implement the project or not. The choice of the investor depends on the outcome of the comparison between the IRR determined as described above, and a rate that defines the minimum expected return from that particular subject in relation to the specific transaction. The problem identified in the calculation of NPV, i.e., the choice of the discount rate, is therefore replaced—in the use of IRR—by the choice of the so-called minimum acceptable rate of return (MARR). As a matter of fact the two problems are perfectly super imposable if on the one hand, the solutions in which the IRR is higher than the MARR are considered to be acceptable, and on the other the choice of the MARR as a discount rate supplies positive NPVs for the same solutions.

From a practical point of view the IRR, which requires the solution of an equation of n degrees, can be obtained by trial and error or successive approximations, and by proceeding to recalculate the NPV with r gradually increasing (or decreasing) to obtain a value close to zero.

Generally, for the determination of the IRR, the equation to be solved should be the following:

$$F(r) = 0,$$

where F indicates the difference between the present value of the revenues and costs of the investment. The solutions of $F(r)$ are those that are financially acceptable; obviously complex or imaginary solutions cannot be accepted.

If the investment matches a series of initial costs, followed by a series of revenue (and where the discounted costs are lower than the revenues discounted), then the curve that represents the NPV function of assay intersects once l 'x-axis and $F(r)$ admits only one positive real solution (Fig. 6.5).

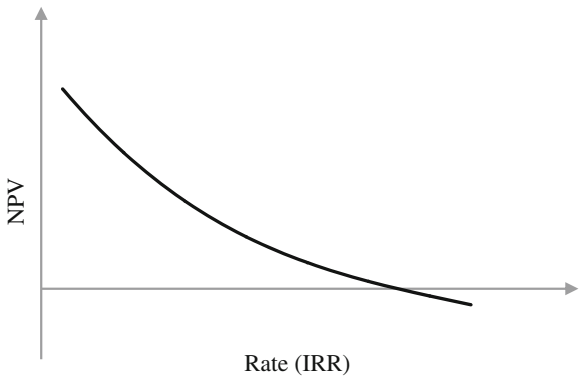


Fig. 6.5 NPV and IRR

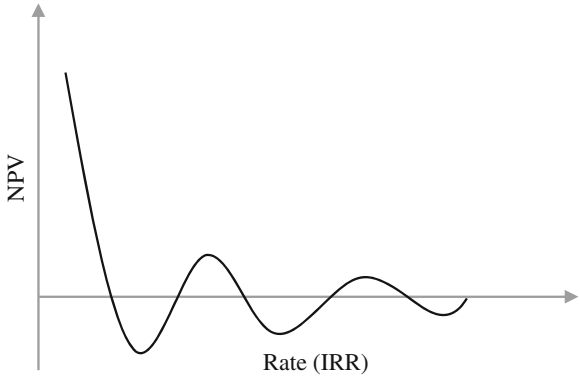


Fig. 6.6 Multiple IRR

If in the DCF there is an alternation of positive and negative net flows, problems may arise in the definition of the IRR, as the presence of multiple IRR, where the curve of NPV (Fig. 6.6) has more of an intersection with the x-axis, or the indeterminacy of the IRR (the curve has no intersection).

If one encounters these situations, it is still possible to adopt procedures able to guarantee a result. In case there are no real solutions available, one option is to eliminate a change of sign (maybe distributing the figures over several periods) and then redo the calculation to obtain a solution.

The situation with multiple IRR, i.e., with more than one real solution, is more delicate. In this case if in fact one is using the iterative and automatic calculation formula on spreadsheets, it is likely, if the solution found is not clearly erroneous, to interpret it as the correct solution. Therefore, it is appropriate, when there is more than one sign variation in net flows, to verify the solution, for example through the analytical study of the function $F(r) = 0$. From the operational point of view, a possible approach in solving the problem of multiple IRR is the calculation of a *Modified IRR,* to move back (discounting) to the beginning of period costs and forward (postponing) the income to obtain a single sign variation. The operations of anticipation and postponement are obviously performed by adopting an interest rate

Table 6.14 Calculation of the Modified IRR

Cash flow forecast—year 2	€8,500
Initial value of cash flow	
Year 2: [€8,500/$(1 + 0.15)^2$]	€6,427
Initial expenditure	€2,300
Initial value	€−8,727
Cash flow forecast—year 1	€9,800
Final value of cash flow	
Year 1: [€9,800 × (1 + 0.15)]	€11,270
The Modified IRR is the rate that allows to get a present value of €8,727 discounting the final value of €9,775	€8,727 × $(1 + \text{IRR})^2$ = €11,270

Modified IRR is 13.64 %

that reflects only the cost of the transfer of money (cash) that is included in the time without the risk associated with the particular investment activities.

Another method that avoids the problem of multiple solutions is the calculation of *Adjusted IRR*. This technique eliminates the sign variations in the cash flow of the *i*-th year, adding part of the adjacent flows, discounted at a fixed rate in order to meet the temporal fairness.

Example 6.4 An investment proposal that requires an initial outlay of €2,300, promises to earn €9,800 by the end of the first year. After taxation and expenses to cover financing, the transaction will be completed at the end of the second year with a loss of €8,500.

The calculation of the IRR provides two solutions: 21 and 204 %. Neither are correct. Modified IRR is then calculated, using a discount rate (for transactions of accumulation of flows) of 15 %. The results are listed in Table 6.14.

This technique is very sensitive to the rate used in the operations of accumulation. At rates of 10 and 20 % respectively, obtained an $\text{IRR}_{10} = 7.52$ % and an $\text{IRR}_{20} = 19.74$ %.

The calculation of the IRR, in this case, compensates the negative input of the second year (€8,500), and cancels the change of sign, using the cash flow for the first year. If one considers a reinvestment of €9,800, assuming a 15 % rate at the end of the second year, there is a value of €11,270. The last year of management recorded a positive entry of €2,770 = €11,270 − €8,500. The rate that allows one to gain the final amount of € 2,770 starting from the initial investment of €2,300 is 9.7 %. One still gets a different rate from that result from the application of the modified IRR.

The basic problem of these calculation gimmicks lies in the need to find a new "intermediate" rate with which to perform the accumulation of cash flows. This parameter, in the case of modified IRR and adjusted IRR, is unique and is used to move through time both the positive cash flows and both the negative ones. Some analysts believe that it is not appropriate to use a single rate, the determination of which would still be appropriate to discuss. They think that they need at least two intermediate rates: one that takes into account the cost of capital to be used to discount negative cash flows and the other fixed rate according to the real possibility of gain on reinvested funds, used to accumulate revenue positive at the end of the projection period. By doing this one gets a new formulation of IRR, that in Anglo-Saxon countries is called financial management rate of return (FMRR). It is still an attempt to bypass the limitations of the IRR.

The problem of alternating negative and positive cash flow, which in theory does not seem satisfactory in resolving the limits of the proposed methods, is actually less significant in the analysis of real estate investments which are usually characterized by an initial period of negative flows (processing costs) followed by a second period of positive cash flows (rental, sales). So the problem of interpretation of IRR remains, i.e., the definition of the threshold of acceptability of Real Estate investment, in other the choice of the discount rate to use for the calculation of NPV.

Today, the calculation of the NPV and IRR is highly facilitated by the use of computers, even software in common use, as Excel, have functions that allow the automatic calculation of both the NPV, IRR of both.

NPV and IRR are both an expression of the same criteria based on the comparison with the rate of return required by the investor. A positive NPV is equivalent to a greater IRR rather than the minimum required rate of return. This circumstance does not imply an immediate decision about investing, but it is only part of a procedure leading to the final decision. The investment involves, of course, a renunciation of the use of resources that could have alternative uses in other investment initiatives. The choice could therefore lead to a comparison between investment alternatives.

The two parameters—NPV and IRR—may show some limitations when used for inter-project comparisons aimed at defining an order between possible investment alternatives. In fact, it may happen that the order derived from the use of NPV as a criterion of choice, does not coincide with the order defined by IRR. As the example of Fig. 6.7, fixed the minimum rate of return in 5 %, the calculation of the NPV indicates that project A (dashed line) is more convenient than project B (solid line). However, the order is reversed if one uses the IRR as criterion of choice. The NPV promotes projects with greater capital intensity.

An obvious limitation of the NPV is connected to the choice of the minimum expected rate of return. The choice of the rate may change the order of preference. Specifically higher rates are disadvantageous for those investments whose revenues are more distant in time. On the other hand, the IRR is not immune from the lack of insensitivity to the relative size of the projects. This shows that neither the

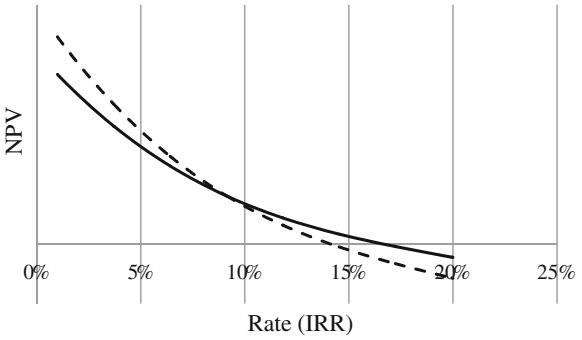


Fig. 6.7 Example of a possible relation between NPV and IRR

NPV nor the IRR are perfect markers and there is not a parameter that is good or better than the other is.

Some analysts question the usefulness of the IRR, highlighting the critical issues relating it to the issue of reinvestment of cash flows. This problem also arises when comparing investment alternatives characterized by very different patterns of cash flows. IRR calculation implicitly assumes that the revenues are reinvested at the internal rate of return. This means that the IRR method is discriminating, in the case of inter-project comparisons, only if one can invest the revenues at an equally high active interest.

Example 6.5 An investor must choose between two alternatives that require the same amount of initial outlay and have an identical time horizon. The expected cash flows are listed in Table 6.16. The Investment A (IRR = 20 %) seems cheaper than the B (IRR = 18 %) (Table 6.15).

Assuming now that the maximum available gain on reinvested funds is 10 %, the internal rate of return is calculated. In this way, the IRR of the alternative A drops to 17.24 %, and is lower than that calculated for the alternative B. It reverses, therefore, the hierarchy between the two possibilities of investment (Table 6.16).

The problem of reinvestment rate prejudices the use of the technique of the Internal Rate of Return, even when alternative investments have different durations. Example 6.5 is proof of it.

Example 6.6 An investor must choose between the two alternatives shown in Table 6.17.

Both alternatives have an IRR of 15 %, but they are equally desirable only if the reinvestment rate continues to hold 15 %. If one reduces the reinvestment rate of 10 %, the alternative A proves to be less convenient B.

Table 6.15 Cash flows relating to two investment alternatives and measure of the IRR

	Investment alternatives	
	A	B
Invested capital	€10,694	€10,694
Net cash flow, 1st year	€7,000	€0
Net cash flow, 2nd year	€7,000	€14,890
	Reinvestment at IRR = 20 %	Reinvestment at IRR = 18 %
Cash flow—year 1	€8,400 = [€ 7,000 (1 + 0.2)]	€0
Cash Flow—year 2	€7,000	€14,890
Total	€15,400	€14,890
Present value	$[€15,400/(1 + 0.2)^2]$	$[€14,890/(1 + 0.18)^2]$
Invested capital	€10,694	€10,694
NPV	€0	€0

Table 6.16 Cash flows relating to two investment alternatives with income reinvested at different rate from the IRR

	Investment alternatives	
	A reinvestment at IRR = 20 %	B reinvestment at IRR = 18 %
Cash flow—year 1	€7,700 = [€7,000 × (1 + 0.1)]	€0
Cash flow—year 2	€7,000	€14,890
Total	€14,700	€14,890
Present value	$[€14,700/(1 + k_A)^2]$	$[€14,890/(1 + k_A)^2]$
Invested capital	€10,694	€10,694€
NPV	$k_A = 17.24$ %	$k_B = 18$ %

Calculations show, in fact, that the total gain in the period of 5 years is 11.9 % for the Investment A and 12.7 % for B (Table 6.18).

Regarding the problem of reinvestment, the opinions of the analysts do not agree. In fact it is difficult to argue that the reinvestment always give the same return as the initial investment. The assumption of reinvestment at equal rates to those of the investment also highlights a further forcing. In fact, when one compares the two operational alternative proposals that have different rates of profitability, their income will be reinvested with different rates of profitability. This seems unrealistic.

For this reason some privilege the method that here is defined calibrated (CIRR), able to always provide unique solutions. To calculate the CIRR the formula IRR should be amended as follows:

Table 6.17 Cash flows for two investment alternatives

	Investment alternatives	
	A (€)	B (€)
Invested capital	22,832	33,522
Estimated cash flows		
Year 1	10,000	10,000
Year 2	10,000	10,000
Year 3	10,000	10,000
Year 4	0	10,000
Year 5	0	10,000

Table 6.18 Cash flows related to two investment alternatives with income reinvested at different rate from the IRR

	Investment alternatives	
Future value of cash flows with the chin reinvestment rate of 10 %		
	A	B
Year 1	€14,641	€14,641
Year 2	€13,310	€13,310
Year 3	€12,100	€12,100
Year 4	€0	€11,000
Year 5	€0	€10,000
Future value of all cash flows	€40,051	€61,051
Discount rate that deletes NPV	11.9 %	12.7 %

$$\sum_{t=1}^{N} \frac{CF_t \times (1 + r_t)^{n-t}}{(1 + i)^t} - CI = 0$$

where r_t represents the rate of return on reinvestment of positive balances. The CIRR is the value of i that reflects the positive balances in order to equalize the initial investment.

Naturally the CIRR is equal to the IRR when $r = i$. If $r_t > i$, then the CIRR is greater than the IRR and vice versa.

According to Marshall's preference of CIRR over IRR is justified because the former "incorporates the expected real income from reinvestment of profits while the IRR assumes that the reinvestment makes as the initial investment, without that there is a logical basis for this assumption. In addition, when comparing two alternative programs with different IRR, we speculate that even the reinvestment rates are different, when in fact it would be logical to expect the same rate of return from the reinvestment of the profits of both programs".

If one wants to use the CIRR instead of IRR, one could use either the official current discount rate or the current yield of government bonds as a reinvestment

rate, and still apply the same discount rate to all possible alternatives taken into consideration.

Other authors consider the IRR more technically correct. Kerr (1980) rejects the CIRR because "the models based on the reinvestment rate, created to avoid the ambiguity of the IRR, are incorrect because the measure of the desirability of a potential investment is contaminated by the projected income from other investments".

Finally, there are those who recognize that both IRR and CIRR have pros and cons and that each one may be preferred to another depending on the circumstances (Raper 1981).

NPV and IRR are thus two decision criteria that share the same mathematical formulation and, to some extent, the same gaps. The border between the merits and demerits of the two indicators is very thin. The literature is full of texts that favour one or the other method, and support these choices with a wide variety of reasons.

6.4.4 Other Indicators

It has been said that the use of profitability indexes (IRR, NPV) could bring out some problems with the interpretation of the result when there is the need to make inter-project comparisons, especially in situations with different timing flows and amount of capital. Therefore it may be useful, in order to complete the picture of the information needed for the final choice, to measure another indicator: Discounted Benefit/Cost (B/C) Ratio. This parameter is not an alternative to NPV or IRR but because of the limitations and difficulties associated with its use, it incorporates the previous information.

It defines a profitability index (PI), calculated by dividing the present value of expected cash flows to the initial capital invested. The quotient is the current value for every euro of initial outlay. The choice must fall on the project that has the highest profitability index, unless there are substantial differences in the risk profiles of the various alternatives.

$$PI = \frac{CF\ Actual\ Value}{Initial\ Investment}$$

When one uses the profitability index as a tool for the preliminary identification of investment opportunities that require further analysis, the rule, to discard the alternatives with a *PI* less than 1, obviously applies. This, of course, is the variant of the rule that requires not to consider projects that have an NPV less than zero.

The net present value is a more appropriate criterion with respect to *PI*, when the investor has to decide about the convenience of mutually exclusive opportunities. In situations where one has to choose, for example, between financing alternatives, or whether to rent or to buy, whether to sell or to buy, and generally

Table 6.19 Calculation of NPV and B/C to investment alternatives

	Investment alternatives	
	Mall	Office building
Discounted net cash flows	€90,000	€110,000
Initial expense	€−60,000	€−75,000
Net present value	€30,000	€35,000
Profitability index	1.50	1.46

whenever one finds ourselves at a crossroads, it is preferable to use the approach of NPV, because it better expresses the gain obtainable from the project.

Example 6.7 An investor owns a piece of land worth €60,000, which would be used as mortgage collateral to access a loan to be used to build a small mall. Alternatively, investing equity capital for an amount of €15,000, in addition to the capital obtained through financing, he could construct an office building. The present value of the expected cash flows from the "mall" solution is about €90,000, and in the case of the "office" solution, €110,000.

Calculations in Table 6.19 show that the *PI* and the NPV give different signals. In this case, the investor must rely upon the information provided by the Net Present Value, because this criterion shows what really is obtained from the project.

In the field of real estate, one may also have to decide between various mutually dependent investment proposals. If the investment decisions are connected in this way, one has to build the various possible combinations and treat each of them as an opportunity, independent from the others.

Another indicator is the discounted payback period (DPP), which is the time (measured in years), after which the current value of the expected cash flows, that result from the investment, equals the investment itself. This procedure is similar to a payback period; however, the payback period only measures how long it takes for the initial cash outflow to be paid back, ignoring the time value of money.

The DPP is the minimum value that satisfies the equation:

$$\sum_{t=1}^{Y} \frac{(B_t + C_t)}{(1+i)^t} = C_o$$

i the discount rate.

If the annual net earnings are constant over time, the solution will be:

$$DPP = \frac{\frac{1}{1-(PP \times i)}}{\log(1+i)}$$

When $i \neq 0$, since for $i = 0$, DPP = PP.

If the net income varies over the years, one has to add up, year after year, their present value until the amount received does not equal or exceed the initial investment, as in the previous example.

An alternative procedure to detect DPP is to find the moment when the IP ratio is equal to 1. One has to compute this ratio for each year of the analysis period (holding period), proceeding to subsequent attempts until the one closest to the unit indicates the DPP sought.

Although this indicator has strong limitations, it does not provide any indication about the optimal size of the investment or about the economically more efficient choice between alternative investments.

The payback period is a parameter investors like to see, given its immediate and easy interpretation. This method, however, can lead to misconceptions about the potential of a real estate investment: properties can provide high profitability but on a longer time may be less convenient than others that concentrate most of the benefits in the early years of the holding period.

6.4.5 The Discount Rate

An important problem remains to be analysed: the choice of the discount rate, i.e., the minimum rate of return.

In the examples in this section, one saw how a small adjustment in the selected rate may produce huge changes in NPV, or profoundly alter the hierarchy of investment opportunities, especially when the expected cash flows have very long and different temporal distribution patterns. The determination of rate should be carried out, therefore, with the utmost care.

One of the methods proposed for this task is based on the consideration that the investor commits his money, and this requires a fee, the motivations of which are reflected in an equivalent number of components of the reference rate. The latter can therefore be obtained by the following sum:

Reference Rate = Risk Free Rate + Fee for	Risk tolerance Waiver of Immediate Consumption Lack of Liquidity Portfolio Management

The base rate (risk-free) corresponds to that definite return that it is owed to the investor, merely for the wait.

In the absence of risk and should the aim of maximizing the profit prevail, the penalization of flows that are more distant in time by applying a discount factor is justified by the implicit opportunity cost of invest an amount of money in the financial markets, that is, giving it in loan at an interest rate *r*. This rate, in a world of certainty, can be thought of as the interest rate applied to a solvable borrower. This is usually the State.[5] For this reason, the interest rate paid on short-term Treasury bonds, on bonds that do not involve risks, whose limited duration is a guarantee against risks of loss due to inflation, is usually called *risk-free* rate. There are, however, obvious difficulties in the appropriate estimate of the remaining terms of the sum. This approach is therefore impractical.

The problem is simplified by reducing the sum of just two terms: the risk free rate and the risk premium. The latter, which is required to compensate for the tolerance of risks, changes depending on the investor's ability to perceive and accept the dangers of failure. In the preceding paragraphs, it has already been pointed out that the compromise between risk and yield varies from one investor to another. It is a question of individual function, but the rule is that the intensification of perceived risk grows proportionally to the premium required to bear them.

Another way to determine the reference rate is to refer to the marginal cost of capital, i.e., the cost of an additional euro of investment. In real estate investments, he marginal cost may be denoted in the annual expenditure for repayment of the loan.

Many analysts agree, however, to recognize a greater significance to the approach of the cost as capital opportunity. This concept is equivalent to the maximum gain that the investor can obtain by engaging funds in alternative investments that are available and characterized by the same kind of risk exposure. Since it is unlikely that the investor agrees to venture into a project that provides a gain that is lower than that obtainable through equally risky transactions, the opportunity cost coincides with the minimum acceptable rate of return. Its use as a discount rate allows to compare projects classified in the same risk category, even when there are large differences in the amount and the timing of cash flows.

It summarizes the approach of the marginal price of capital and the opportunity cost, the weighted average cost of capital or WACC. It represents the cost borne by the investor to compensate the equity used in the real estate transaction and debt, which is the capital provided by third-party lenders. The formula operates the weighted average; the WACC is calculated taking into account the relative weights of each component of the capital structure, including the cost of equity and cost of debt:

[5] It is worth mentioning that in spite of the name, even the government bonds issued by the State are not immune to inflation risk.

$$WACC = k_e \frac{E}{(D+E)} + k_d(1-t)\frac{D}{(D+E)}$$

where:
k_e cost of equity;
E total shareholder's equity;
D total debt;
K_d cost of debt;
t tax rate on income taxes.

As far as the quantification of the two components of the WACC is concerned, the equity cost, which immediately calls to mind the "cost opportunity" concept, re-proposes evaluation problems that have already been highlighted.

References

Csillaghy, J. (1985). *Economie de L'environnement Construit*. Lausanne: IREC.
Dixon, T. J., Crosby, N., & Law, V. K. (1999). A critical review of methodologies for measuring rental depreciation applied to UK commercial real estate. *Journal of Property Research, 16*(2), 153–180.
Fisher, J. D., Smith, B. C., Stern, J. J., & Webb, R. B. (2005). Analysis of economic depreciation for multi-family property. *Journal of Real Estate Research, 27*(4), 355–369.
Kerr H. S. (1980). A final word on FMRR. *The Appraisal Journal*, 102.
Manganelli, B. (2011). *Il Deprezzamento Degli Immobili Urbani*. Milano: Franco Angeli.
Raper C. F. (1981). Equity yields ant the reinvestment issue. *The Appraisal Journal*, 519–552.

Chapter 7
The Risk Analysis

Abstract The topic of risk management is one of the main problems that investors have to deal with. There are many variables that identify the risk of an investment, many are also subjective in nature. This makes the task of the analyst who wants to incorporate the risk factor in the assessment of convenience, a difficult one. The analyst will have to study and investigate the correlations between the specific objectives of the investment and the probability estimates of returns. In the analyst's help section, the traditional methods for the treatment of risk are explained, based on the subjective perception of the risk itself, as well as the more complex approaches that make use of the probabilistic analysis, instead.

7.1 The Variables and Risk Factors

The analysis of the allocation of resources, discussed above, has as its object the definition of the logical and fundamental tools for investment evaluation in contexts of certainty.

It is necessary at this point to introduce the possibility of uncertainty and imagine, in line with what happens in reality, that most of the investments generate uncertain cash flows both in terms of the entity and that of the time limits.

The risk theme in the investment evaluation is one of the main problems that investors have to face. The volatility of the financial markets and the increasing competitiveness, which occur both in mature sectors and in those characterized by strong technological innovation, are in fact continuously paying the problem of controlling and managing the uncertainty that usually characterizes the process of analysis that leads to the assumption of strategic decisions.

From a merely formal point of view, the concept of uncertainty is distinct from that of risk. An investment is considered risky even when the results produced by it cannot be determined with certainty, however, it can make various assumptions about future results, each of which is associated with a given probability value, so as to build the entire probability distribution of event.

B. Manganelli, *Real Estate Investing*, DOI 10.1007/978-3-319-06397-3_7

The uncertainty involves an unknown number of possible outcomes, with insignificant information about its chance of occurrence. It takes over when it is not possible to establish a priori a probability distribution to be associated with different outcomes of the event. By definition, the uncertainty is not measurable, so there is no way of communicating a "degree of uncertainty". From the point of view of the decision maker, this is the worst condition, the one in which anything can happen.

Surely, it is preferable to operate under conditions of risk, since, in this case, the possible outcomes are known and the analyst is able to estimate the relative probability.

If a situation is uncertain, but the possible consequences and their probability of occurrence are known objectively, the situation involves risk or objective uncertainty. When the possible outcomes are known, but their probabilities of occurrence are not objectively known, the situation involves uncertainty or subjective uncertainty, and finally, when the list of possible outcomes is not clearly defined, the situation involves ambiguities or unforeseen contingencies.

A good investor will always tend, as far as possible, to convert the elements of uncertainty in risk factors, forcing the analyst to a continuous process of research and arrangement of data in order to produce and incorporate in the analysis, new "objective" deployments of probability.

In this context, the term uncertainty will be used as a synonym of riskiness, regardless of the formal specification just made, thereby opposing the concept of certainty. Therefore, under conditions of uncertainty, an investment cannot be described by a single cash flow, but by a series of flows in each of which a given probability distribution can be associated.

The measure of risk attached to the investment is given by the dispersion of the different expected results. On a general level, it can be said that an investment is even more risky as the possible outcomes resulting from it are scattered around the expected value. The dispersion of the expected values of a project is also identified with the term volatility. In order to provide the first concrete perception of the concept of dispersion or volatility, Fig. 7.1 compares the expected results (or yield) of two investment projects, A and B, which have the same level of average expected return.

As one can see from the comparison between the two graphs, the individual values of project A have a lower dispersion than the expected average, which on average are less distant from the line compared to the same points of project B. There is no doubt that a rational investor, faced with the choice between A and B, would prefer A, which has the same return at a lower risk.

The risk element is a feature of all kinds of investment. The major uncertainty factors of real estate market have already been illustrated and it has also been explained that the investor, facing the danger of failure of an operation, may have a different behaviour, even in terms of specific strategies and perception of risk.

The many variables that identify the investment risk, many of which are subjective, realize the difficulty of incorporating the risk factor in the analysis, through formalized procedures and techniques. The forecast of cash flows of a real estate

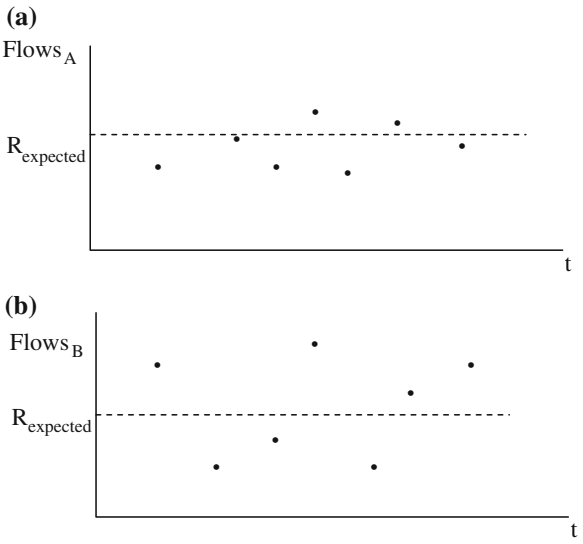


Fig. 7.1 Dispersion of the expected returns of the two projects

investment is a complex task. This does not exempt the analyst from the task of streamlining an effectively complex problem, through the study of the correlations between the specific objectives of the investment and the probability estimates of the possible returns.

While acknowledging the entrepreneur's innate capacity to deal with the risk factor in an intuitive way, it is useful to try to make the choices easier, and at the same time highlight the possible consequences (see footnote 1 in Chap. 1). The need to support the final decision therefore involves the effort to provide investors with all the necessary elements to frame the sources of risk and in assessing the probability of ticking off gains equal or bigger to the minimum acceptable.

The discount rate used to calculate the NPV, which is the minimum acceptable IRR, has been interpreted as the sum of several components, one of which is identified as a premium for the risk of investment. The problem is therefore to correlate the risk to profitability.

First, one needs to identify the risk factors that characterize investments in the real estate field. A very general classification of risk factors in business risks, financial risks and external risks was previously laid out. In relation to this preliminary distinction it is then possible to identify the risk factors with reference to other possible real estate investment classifications (even overlapping each other). If one looks at the object of the investment it may, for example, be useful to divide the risk factors in exogenous, which are common to any investment, or in specific risk factors, related to the specific asset. Exogenous factors are the general economic conditions, interest rates, employment and inflation, taxation and government policy. Specific risk factors are the location, financial-income characteristics of the lessees, the quality and the fungibility of the asset.

One can also distinguish economic risk from technical risk. The economic risk depends on factors that are extrinsic to the project to be evaluated. In the economic risk the tenant's risk[1] is contemplated. It concerns the possible difficulties related to the actual collection of the rents.

The characteristics of the conductors in terms of reliability and contractual power may affect the variability of returns. The losses on rentals or delays in the collection can result from non-payment, tenant's insolvency or contentiousness, conditions that often produce the need to renegotiate the fee or a temporary vacancy of the property.

One must also keep in mind that every time it is necessary to recover unpaid rent, it involves very expensive legal actions.

Another factor of economic risk, which could affect the cash flows expected from the investment, and somehow related to the tenants' risk, depends on the location of the building within the urban context. The importance of the city and/or of the area in the city in which the property is located, can tell us a lot about the income, cultural characteristics and mobility of the population, and therefore the reliability of the lessees and the resulting stability of returns. The concept of zone of prestige is obviously in function of the type of target property. The importance of a particular location in relation to the other depends on the presence, in terms of quantity and quality, of services, facilities and infrastructures, therefore on the ability to attract that particular category, be it residential, commercial or productive.

The last economic risk factor is related to the volatility of the market in general, and that of the local market. As far as the real estate market in general is concerned, the main determinants of supply and demand have already been illustrated, the factors that can determine a variation in prices, use or sale and therefore the expected cash flows from the investment.

The technical risk depends on factors that are intrinsic to the project, including the specific destination, the connotations of quality and appearance of the building, the characteristics of fungibility of the asset. This uncertainty often leads investors to anticipate the start of the project in order to collect information on the potential transaction. Events within the investment process are also part of this specific risk, namely those stages of development in which the risk is related to the possibility of inappropriate choices. For example, an inefficient construction management may cause an increase in construction costs, inadequate administration may result in a vacancy rate higher than expected, and finally an inadequate sales plan can seriously affect the longed-for gain.

Another conceptual category concerns the distinction between operational and financial risk. Operational risk refers to the variability of the results that derive from the organizational structure of the investor and in particular from his activities. The concept of financial risk includes within itself a whole series of elements

[1] In this regard Fiedler and Janda (1993) point out that "the extent of the risk could be not a science but an art".

that are relevant to the management of the financial and monetary aggregates. From a purely conceptual point of view it is possible to distinguish the financial risk into two basic components:

- Risk of leverage;
- Interest rate risk.

The risk of leverage is directly associated with the financial structure. The financial leverage ratio is the relationship between interest-bearing debt and equity, and indicates the extent to which the management company is financed by recourse to debt capital.

In dealing with the issue of funding it has been highlighted how a positive financial leverage expands the return of personal capital investment, if the cost of the loan is less than the income obtained from the building. However, the use of an ever growing loan amplifies the variability of the expected results and produces an increase in the financial risk. Figure 7.2 shows this situation qualitatively.

Another type of financial risk is one that materializes when excessive debt increases the probability of not achieving a net operating income sufficient for the payment of the amortization (risk of default).

Figure 7.3 illustrates the risk of insolvency that may occur in the case of a complex of apartments for rent. In the absence of funding, the balance between costs and revenues is reached at point A, to a relatively low level of employment. If one resorts to the loan, will need to maintain a very limited vacancy rate (point B) to ensure the solvency of the revenues.

Interest rate risk arises in the possibility that, given the volatility of the markets, a change of market interest rates leads to an unexpected cost for the investor because of the discrepancy between lending rates and deposit rates that characterize the assets and liabilities.

The analysis of operational and financial risk helps to understand the concept of irreversibility of decisions.

Ceteris paribus, if the weight of fixed costs gets larger, the costs of abandonment of the project increases, and it becomes less and less reversible. In such circumstances, a positive NPV may not be enough to convince the investor to take the risks that the structure of the project entails. The irreversibility of certain decisions is therefore a deterring factor for the investment.

Another distinction relates to the insurability of the risk. Those risks related to natural disasters and not (fires, floods, storms, etc.) and which may be transferred, by payment, to the insurance companies are defined as insurable.

The final level of analysis is related to the distinction between systematic risk and sectorial or non-systematic risk. The first relates to those events of general scope that cause an impact on the economy as a whole. An example of systematic risk factors is the sharp increase in the price of oil, an extended armed conflict, a sharp rise in the discount rate, the declaration of bankruptcy of a State.

Against this, there are also peculiar risks for a particular field. Within this risk category, so-called sector risk, are all the factors that come from competitors, industry and production factors.

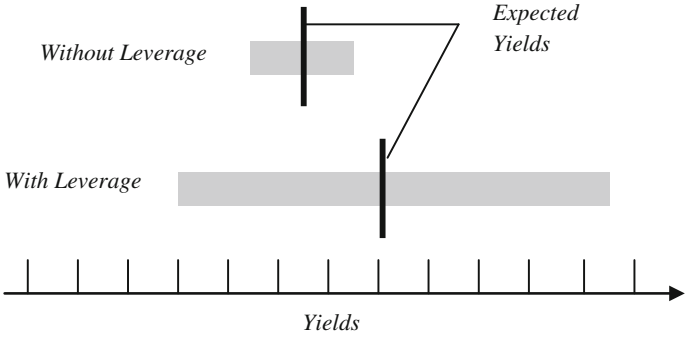
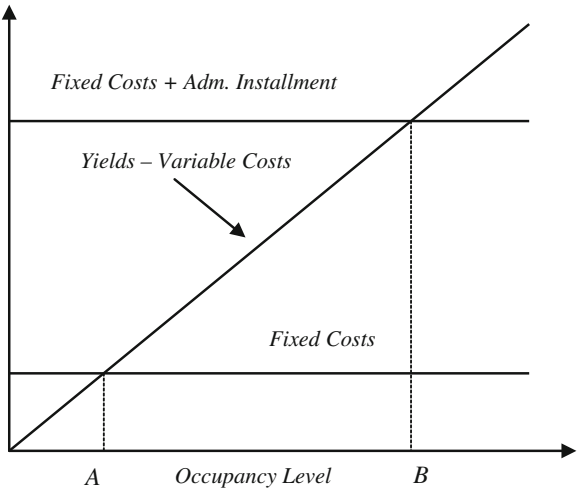


Fig. 7.2 Leverage and variability in yield

Fig. 7.3 Financial Leverage and insolvency risk



In particular, the sector risk can be thought of as the total of factors that cause a loss of competitiveness of the investment, especially in those fields where the technological component and the level of innovation of the production process are crucial. The specific source of risk for a Real Estate investment can be recognized in the well-known phenomenon of technological obsolescence.

7.2 The Analyst's Task

Despite the low incidence of the cost of the design on the total cost, the role of the Architect/Engineer is essential to the economic performance of building initiatives, more than each of the other operators. It is therefore necessary that the

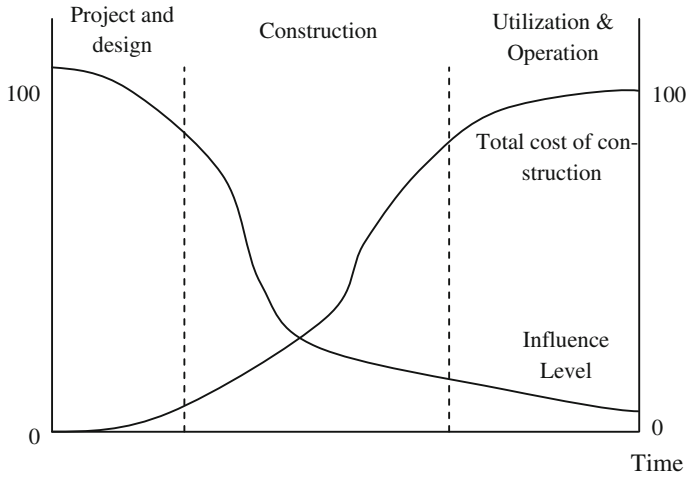


Fig. 7.4 Influence of the phases of the construction process on construction costs

designer coincides with the figure of the analyst, or at least has the knowledge required to work with the latter.

In fact, several authors state that during the completion of 20 % of the preliminary draft, 80 % of the cost has already been decided (Kelly 1984). Figure 7.4 illustrates this situation.

This shows how it should be, on the one hand, to spend a greater attention to the preliminary stages of the project and on the other, under the predominant influence of the project moment on the costs for construction and use of the buildings, that the Architect/Engineer is fully aware of the economic consequences of his choices.

The analyst, in estimating the costs, especially when it is necessary to refer to the concept of rapid estimation, must be firmly anchored to the principles of the estimation discipline and avoid that the investment is underestimated or overestimated. It is expressed in its normal consistency, in reference to all the factors that may intervene later. Any subsequent adjustment should be aimed at not saving the project, but at its completion.

The lack of knowledge of the detail of the character of the project, cannot lead to justifying, beyond a certain threshold, the deviation between the calculated costs in decision-making and those defined later.

Another fundamental aspect of the analyst's work is that of communication with the investor client. The problem becomes complicated especially when one has the need to provide a comprehensive overview about the risk of the intervention. As shown in the next chapter, there are several techniques that allow to incorporate the risk into the analysis, it is not easy to understand how they all handle the risk. Traditional approaches suffer the effects of the subjectivity of the analyst, and even the most accurate estimates may be unclear to the decision maker. It so happens that the analyst, in adjusting the estimates based on his sensitivity, does nothing more than make decisions for the client, barring any

possibility of choice. A similar approach may be acceptable only when the analyst and the client share the same kind of perception of risk, but this is a utopian condition.

7.3 Risk Control

The increased attention to risk analysis in real estate is a relatively recent fact. It has become of significant interest to the business world in the last few decades and at unfavourable cyclical phases during which not all projects have automatically reached success.

When it was understood that real estate investing is not immune to the dangers of failure, literature has been enriched by works on sophisticated techniques of risk control, traditionally adopted in other areas of the economy. These approaches, however, are often insufficient for real estate reality: the greatest benefits conferred by such analyses do not justify the cost and time needed to obtain them. For moderate-sized projects, and in cases where the results are predictable, the use of a less complex analysis is more appropriate. Many of these simple procedures for risk reduction are applied by the investor who is not always aware of the situation. It is about attitudes, rather than rules. The easiest way, but certainly not the most obvious, is to control the risk by investing in less risky projects, and by accepting only those opportunities that guarantee, with a very small margin of uncertainty, the achievement of certain results. Unfortunately, even in an imperfect market such as real estate, such behaviour means to preclude other possible extraordinary gains, given that there is a proportionality—as already mentioned—between perceived risk and expected returns.

In an efficient market, the observed results (profits made) are distributed randomly around the line of the expected results (Fig. 7.5), so that the upper and lower returns, compared with those expected, tend to compensate each other. On the other hand, if there were investment opportunities with high returns that do not correspond to equally high risks, investors would quickly enter this market, lowering the profits to levels comparable with investments of equal risk that could be implemented in other markets. This means that the only feasible way to minimize the risk in an efficient market is to choose the opportunity with the lowest expected return.

It is known, however, that the real estate market is not efficient at all. As a result, most capable real estate investors have the opportunity to take advantage of these inefficiencies and achieve extraordinary profits without being burdened with an equivalent dose of additional risks. The secret lies in the ability to identify those investment opportunities, the results of which are above the line in Fig. 7.5.

Another way to control the risk exposure is to exploit the relationship between the owned properties and those that could potentially be acquired. Because the factors that affect profits and market values do not uniformly affect all properties, the owners of more diversified portfolios have more stable gain patterns than those

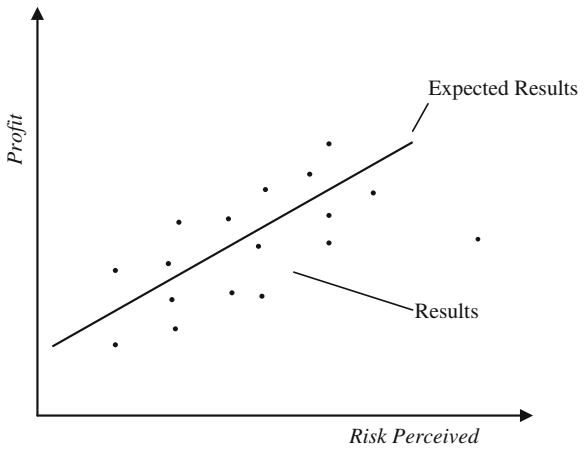


Fig. 7.5 Risk perceived and real returns in an inefficient market

obtained by concentrating all the wealth in a single project. Diversification ensures risk reduction only if the investments are chosen so as to avoid correlations between the patterns of the profitability of the various assets.

Unfortunately, diversification presupposes the availability of a large amount of capital. It is important, having the possibility, to diversify even geographically, in order to minimize the impact of economic crises that affect specific market areas. Another possibility of diversification, but equally expensive, is to invest in different real estate projects, different in type and destination.

Diversification represents an impracticable road for all those investors, most of whom do not have a high enough budget. In this case, the solution is to combine the individual availabilities in common investment funds. Real estate funds are born with the spirit of allowing a remarkable variety to those who do not have the opportunity to make big capital investments.

The investor has other options to limit the risk associated with a given project. He could try, for example, to improve recruitment that makes about the future profitability of a property, reducing the gap between expected and observed outcomes of the operation. A result like this is obtained by increasing the activity of analysis, by using more accurate predictive techniques, and above all by doing meticulous market research.

The risk control action does not end with the final decision; the investor must act in such a way as to conduct the project, during the phases of development and management, towards the results of the predictions. In this sense, control over the supervision of the works and an effective administration, are useful actions.

In addition, the investor can use a number of tools that allow him to partially transfer the risk to other subjects. For example, he could make use of the particular contractual clauses that allow him to shift some risk factors to customers (this occurs with the risk of inflation, when engaging the rent index of consumer prices). Other possibilities of transfer of risk relate to the activation of special forms of prefinancing. Among these, for example, is the exchange in the purchase of land to be

transformed, or, the start-up of options for the purchase of buildings or units being built (sales on paper) which is also very common, so as to have the time to carry out the analysis of convenience, obtain zoning approvals and negotiate a loan.

7.4 Traditional Methods for the Treatment of Risk

Instead of objectively quantifying the perception of risk, analysts and investors are traditionally concerned, according to subjective impressions, to add a premium to the return expected under conditions of normal risk. This additional premium results in shortened recovery times, in demands for higher returns and downsizing of expected cash flows. The effect of this strategy is the reduction in investment values and, often, the consequential waiver of the investment. The inability to quantify the risk element also makes inter-project comparisons complicated.

7.4.1 Risk-Adjusted Discount Rate

One of the traditional ways of response to a condition of uncertainty is to require a shorter payback period. The technique does not measure the risk, but consists of an "adjustment" in the discount rate in order to bring the payback period within the acceptable maximum limit, chosen on a subjective basis. The analysts simply set this parameter, depending on their personal impression.

This is obviously a rather rough method of evaluation, which, on the one hand, assumes that the investor gives up the opportunity to know the true riskiness of the project and to thus implement possible actions resulting from it, and on the other hand the prevalence of the analyst rather than the decision maker.

The problem remains also in the approach that incorporates the risk factor directly in the calculation of NPV (i.e. without reference to the payback period), when one establishes a modified discount rate.

This approach determines the rate as the sum of a risk free rate and a premium that is proportional to the expected perceived risk. The selection of the "risk free" rate is a theoretical problem, rather than a practical one. In general, the choice falls on the rate charged for short-term government bonds. The determination of the risk premium, however, should be based on the function of the investor's risk-return indifference, but, in practice, it so happens that analysts carry out this operation based on their personal perception.

The adjusted discount rate approach is probably the most commonly used, although it does not address the problem of the analyst's subjectivity, and despite the fact that it presents several other theoretical and practical difficulties.

An important issue concerns the calculation of the monetary value of time. This yield is incorporated in the risk-free rate, but inevitably, even the risk premium includes the element related to time equity. As a result, future risks are discounted

more heavily compared to those in the short-term, although often the risks that are closest in time prove to be relatively more important. In a new construction project, for example, the probability of a growth spurt in construction costs or a slower market uptake than expected, is definitely higher than the probability of making significant errors in the estimation of future operating results (revenues and operating costs). Despite operating results that become progressively more predictable because of the development of the neighbourhood, the risk premium with which such operative results are discounted, is equal to the initial one and the corresponding discount factor increases proportionally.

Example 7.1 Consider a five-year investment where the risk premium is estimated at 5 %, while the risk-free rate is fixed at 4 %. Thus, the adjusted discount rate for the calculations is 9 %.

Table 7.1 shows the discount factors for the flow of each year.

The part of the discount factor set aside for the bearing of risk is given by the difference between the adjusted factor $(1.09)^n$ and the risk-free discount factor $(1.04)^n$. The growth of factor in the third column shows that also the risk premium suffers the incidence of time. The monetary value of time, already considered in the risk-free rate, is then set aside twice.

The method of the adjusted discount rate can theoretically be considered correct for those investments whose risks grow over time. For projects where the risk does not depend on time, this technique does not seem appropriate.

7.4.2 Certainty Equivalents

The problem of the double allocation in the approach of the adjusted risk discount rate is bypassed by the approach of the adjusted cash flows, or the *certainty equivalents*. The certainty equivalent is that amount of money that someone would accept, at a given date t, rather than taking a chance on a higher, but uncertain, return; in other words the amount that makes the choice between the same certain amount and the expected result from a risky investment, indifferent. Compared to the previous model in which the project is estimated by taking its expected cash flows and discounting them to a weighted average cost of capital, and adjusted according to the risk, with this approach adjustment for risk is made on cash flow projections rather than on the discount rate. Modified cash flows are discounted at the risk-free rate. This technique also avoids to quantify the perception of risk, but introduces a number of practical problems. First of all, is the problem related to how to "worsen" cash flows to such an extent as to leave the investor indifferent to

Table 7.1 Discount factors for the flow of each year

Years	Adjusted discount factor	Risk free discount factor	Discount factor for risk
1	1.0900	1.0400	0.0500
2	1.1881	1.0816	0.1065
3	1.2950	1.1249	0.1702
4	1.4116	1.1699	0.2417
5	1.5386	1.2167	0.3220

the superior gains relative to the most probable scenario (portrayed with a certain degree of risk), and the absolute certainty of obtaining lower earning of the adjusted estimate.

The method of the certainty equivalents is based on the calculation of the certain equivalent of an uncertain outcome. In situations of adversity to risk, two incomes, one of which is sure Q and one is unsure F, will be equivalent in terms of utility only if the second is greater than the first:

$$Q = \alpha \times F$$

with $0 \leq \alpha \leq 1$.

The coefficient α allows the investor to express the required premium in accordance with their degree of aversion to risk.

Substituting the respective certainty equivalents to Ft random flows, the formulation of NPV will became:

$$NPV = \sum_{i=0}^{n} \frac{Q_t}{(1+r)^t}$$

where the discount rate r expresses, as is well known, the expected return for risk free investments, in line with the nature of the flows to be discounted.

The value of the certainty equivalent Q to be included in the numerator of NPV formula can be derived in different ways.

One of the possible ways is based on the explanation of the utility function of the decision maker. First, one needs to make the client aware of the expectations about the economic environment in which one plans to invest. Once informed on the major elements of risk, the investor must express a preference between the expected cash flows for the analysed project and a large number of "low risk" alternatives. The series of comparisons ends when the investor identifies opportunities to limited gain, but certainly capable of satisfying him the same way as the risky investment.

Example 7.2 Table 7.2 shows the expected cash flow from a project to be managed for 5 years. The income of €120,000, which is expected to be gained from the sale of the estate, will materialize only if the market

Table 7.2 Cash flow and transformation factors related to the certainty equivalent

Years	Expected	Risk free equivalent alternative	Transformation factor
1	€15,000	€14,400	0.960
2	€15,000	€14,400	0.960
3	€15,000	€14,400	0.960
4	€15,000	€14,400	0.960
5	€15,000	€14,400	0.960
6	€120,000	€103,200	0.860

conditions evolve according to analyst expectations. The risk perceived by the investor, as well as his attitude to risk are reflected by the transformations shown in Table 7.2.

The transformation factor is obtained by dividing the risk free cash flows by those expected. For the investor, the expected cash flow of €15,000 with a certain risk, is equivalent to the sure flow of €14,400. The lower reliance in the entry of €120,000 due to the sale, results in a lower transformation factor.

It is understood that the present value calculation takes the following form:

$$PV = \sum_{t=1}^{n} \frac{CF_t}{(1+k)^t} = \sum_{t=1}^{n} \frac{\alpha \times CF_t}{(1+i)^t}$$

where k is the adjusted discount rate, i is the risk free rate and α represents the factor of transformation.

If one is discounting the risk free cash flows equivalent to a risk-free rate of 5 %, one gets the current value of €143,204 (Table 7.3).

To tick off the same current value even from the expected cash flows, one has to apply a rate of 7.7 %. This means that the risk premium can be quantified by subtracting the risk-free rate to 7.7 %:

$$Risk\ Premium = 7.7\,\% - 5\,\% = 2.7\,\%$$

This method allows to approximate the indifference curve of risk-return profile of the investor through the determination of its transformation factors. This operation can be carried out by requiring the investor to express a range of preferences of an appropriate number of combinations of risky and non-risky alternatives. Proceeding in this way it is possible to construct a map of preferences

Table 7.3 Calculation of the PV of the certainty equivalents

Years	Expected cash flows	Present value at 7.7 %	Risk free equivalent alternative	Present value at 5 %
1	€15,000	€13,928	€14,400	€13,714
2	€15,000	€12,932	€14,400	€13,061
3	€15,000	€12,007	€14,400	€12,439
4	€15,000	€11,149	€14,400	€11,847
5	€15,000	€10,352	€14,400	€11,283
6	€120,000	€82,814	€103,200	€80,860
		€143,181		€143,204

that express the individual's attitude to risk. From the map one can extract the transformation factors.

7.5 The Probabilistic Analysis

The NPV in its static formulation assumes that the cash flow and the parameters that define the structure are determined, that is, it is not possible for them to build a probability distribution in relation to the expected values. However, when the cash flows relating to a particular investment are not known with certainty, and one wants to quantify its riskiness, thus overcoming the limitations of traditional methods, it is necessary to study the factors that significantly influence the results. This study should provide a prediction on the measurement of these factors together with the associated probability of occurrence.

The exact estimates of cash flows are developed by considering a specific condition. One can construct a spectrum of forecasts, each of which reflects a set of assumptions about the social and economic conditions that may arise during the investment period. The uncertainty about the course of future events, results therefore, in the development of estimates that identify with a certain degree of "security", the possible or probable results. In practice it is necessary to associate a probability to each possible outcome. The set of possible results with the relative probability of occurrence is the so-called probability distribution.

If the estimate of this probability is performed with statistical techniques, then the risk is measured on objective probabilistic distributions.

For the variables to which one cannot apply any statistical measurement technique, it is necessary to quantify at least the impressions of the analyst, building a risk estimation expressed in terms of subjective probability distribution.[2] The effectiveness of these estimates is influenced by the expertise and experience of those who make them.

[2] The word "subjective" is intended to indicate that the probability estimate is not based on historical data, but on the individual opinion of an expert analyst.

7.5.1 Partitioning and Sensitivity Analysis

Risk control through a probabilistic approach goes, first of all, through the identification of the most significant sources of danger. The technique of partitioning the present value allows the analyst to determine the elements of risk that mostly influence the outcome of the investment.

The method consists in dividing the cash flow, after deduction of tax, in its fundamental components (cash flow before tax, amortization of debt, income taxes, and changes in the value of the property during the holding period, etc.). Expressing the components as a percentage of the total present value, one has the chance to understand the relative importance of each of them. The components with the highest impact on the present value are the ones that deserve further analysis.

The partitioning method emphasizes the relative importance of various types of cash flow and allows to identify the parts of the prediction that deserve further analysis.

The sensitivity analysis extends this process so as to highlight the consequences that, any probable error in the forecasts, they could have on the actual outcome of the investment. The technique consists in altering, one at a time, the components of the expected cash flows and study the impact on the index of return (IRR, NPV, etc.). The purpose of the analysis is to examine the variation of the result at the change of one of the assumptions underlying the project, assuming that the others are unchanged.

Typically, for each variable, one identifies new values (pessimistic, optimistic and intermediate scenarios) and then recalculate the parameters of convenience.

Example 7.3 The property, of which the estimated cash flows are listed in Table 7.4, can be purchased for €1,350,000. A loan of €1 million (repayable over 30 years with monthly payments at 12 %) is available. The investment therefore requires an immediate commitment of €350,000. It is assumed that the property is sold for €1.7 million, at the end of the sixth year.

From the revenue of the sale of the property, extinguishing the remaining debt of €966,373 and paying taxes (€178,000), one will get an additional cash flow at the end of the sixth year which amounts to €555,627:

€1,700,000 − €966,373 − €178,000 = €555,627

This amount is also divisible in:

- Extinguished Debt (€33,627)
- Value increase (€1,700,000 − €1,350,000)
- Taxes (€178,000)
- Recovered Capital (€350,000)

In Table 7.5 the present value is calculated by separately discounting (at 10 %) the components of cash flow. The present value of the components of

Table 7.4 Cash flow expected the next 6 years

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Actual gross revenue (€)	233,000	241,000	249,000	255,000	261,000	265,000
Operating expenses (€)	−18,000	−18,500	−19,200	−20,300	−21,100	−22,000
Actual net revenue (€)	215,000	222,500	229,800	234,700	239,900	243,000
Borrowing costs (€)	−123,482	−123,482	−123,482	−123,482	−123,482	−123,482
Financial flow (€)	91,518	99,018	106,318	111,218	116,418	119,518
Taxes (€)	−30,000	−30,000	−30,000	−30,000	−30,000	−30,000
Net flow (€)	61,518	69,018	76,318	81,218	86,418	89,518

Table 7.5 Present value of partitioned cash flows

Year	Gross effective income (€) $1/(1 + i)^t$	Operating expensed (€) $1/(1 + i)^t$	Borrowing costs (€) $1/(1 + i)^t$	Taxes (€) $1/(1 + i)^t$	Net flow (€) $1/(1 + i)^t$
1	211,818	16,363	112,256	27,273	55,926
2	199,173	15,289	102,051	24,793	57,040
3	187,077	14,425	92,773	22,539	57,340
4	174,168	13,865	84,340	20,490	55,473
5	162,060	13,101	76,672	18,627	53,660
6	149,585	12,418	69,702	16,934	50,531
Total	1,083,881	−85,461	−537,794	−130,656	329,970

Present value of sale flows
Extinguished Debt $\times$ $1/(1 + i)^6$ = €33,627 $\times$ 0.5645 = €18,982
Appreciation $\times$ $1/(1 + i)^6$ = €350,000 $\times$ 0.5645 = €197,575
Taxes $\times$ $1/(1 + i)^6$ = €178,000 $\times$ 0.5645 = €−100,481
Recovered capital $\times$ $1/(1 + i)^6$ = €350,000 $\times$ 0.5645 = €197,575
Total flows present value = €643,621

the expected cash flow is presented as a percentage value Table 7.6. The last column provides a measure of the impact of individual components on the total present value. Note, for example, that the expected results depend very much on the management of the property (71.7 %) and on the increase of its market value during the holding period (30.7 %). It is therefore necessary to give more attention to the estimation of these items.

Table 7.7 shows the influence of an error of ±10 % on the estimated selling price.

Table 7.6 Components of present value

Components of flow present value	Percentage		
Actual gross income	€1,083,881	168.4 %	71.7 %
Operating expenses	€−85,461	−13.2 %	
Borrowing costs	€−537,794	−83.5 %	
Taxes	€−130,656		−20.3 %
Extinguished debt	€18,982		2.9 %
Appreciation	€197,575		30.7 %
Taxes on sale	€−100,481		−15.6 %
Recovered capital	€197,575		30.7 %
Total	€643,621		100 %

Table 7.7 Impact of a variation of ±10 % of the sale price

	Cash flow after taxes		
	Variation −10 %	Expected	Variation +10 %
Selling price	€1,530,000	€1,700,000	€1,870,000
Remaining debt	€966,373	€966,373	€966,373
Sales tax	€160,200	€178,000	€195,800
Sale flow	€403,427	€555,627	€707,827

The present value of the equity position and the value of investment respond significantly to changes in the selling price (Table 7.8).

In Table 7.9, the same procedure is developed assuming an error of ±10 % in the prediction of gross revenue.

Figure 7.6 shows the relationships between the percentage changes in selling prices and gross revenues and the corresponding changes in the value of investment.

By observing the graph of Fig. 7.6, it is obvious that the results of the investment are relatively more sensitive to possible errors made in the estimation of revenues.

In general, besides the example proposed, even small variations of some parameters can significantly change the results. The decision maker, of course, must take into great consideration those key elements of the prediction that, by varying even slightly, may worsen the outcome of the investment by moving them below the minimum threshold of profitability.

Table 7.8 Response to changes in the selling price

Selling price	Flows present value	NPV	Investment value	IRR
Expected	€643,621	€293,621	€1,643,621	26.0 %
−10 %	€612,239	€262,239	€1,612,239	24.9 %
	(−4.8 %)	(−10.7 %)	(−1.91 %)	(−4.2 %)
+10 %	€674,967	€324,967	€1,674,967	27.1 %
	(+4.8 %)	(+10.7 %)	(+1.91 %)	(+4.2 %)

Table 7.9 Responding to changes in gross revenue

Gross revenue	Flows present value	NPV	Investment value	IRR
Expected	€643,621	€293,621	€1,643,621	26.0 %
−10 %	€535,215	€185,215	€1,535,215	20.1 %
	(−16.8 %)	(−36.9 %)	(−6.6 %)	(−22.8 %)
+10 %	€751,992	€401,992	€1,751,992	32.2 %
	(+16.8 %)	(+36.9 %)	(+6.6 %)	(+23.8 %)

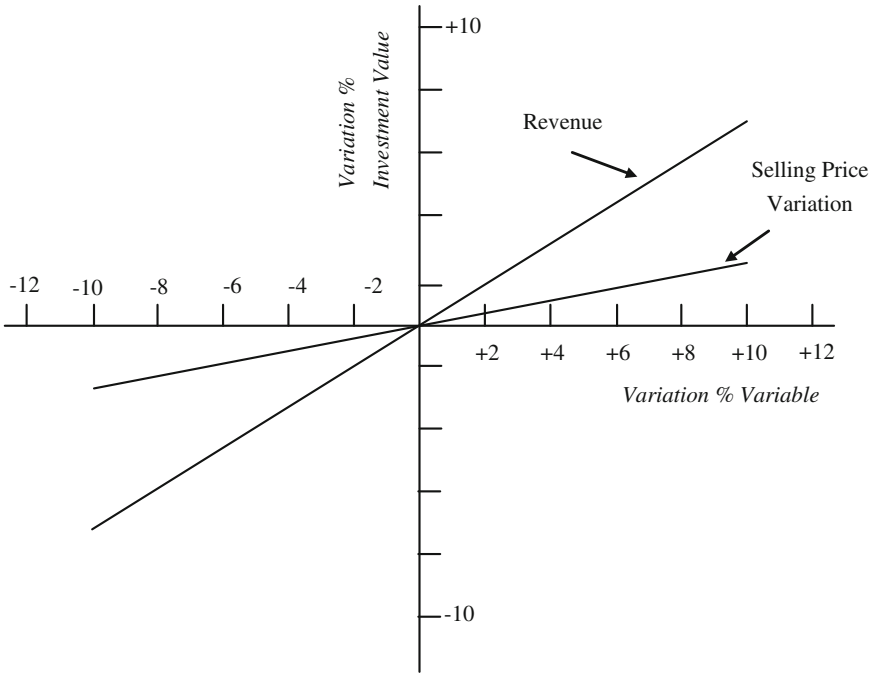


Fig. 7.6 Sensitivity analysis

Figure 7.6 could be completed by adding the sensitivity curves of all the entries in the cash flow. The variables that most affect the results will show a graph with a steeper trend.

Of course, the analyst will have to pay more attention to critical variables. So, if the expected cash flows prove sensitive to changes in the vacancy rate, for example, they will need to develop a more refined analysis of marketability, if the outcome of construction works was sensitive to the time required for the alienation of single real estate units, then it is necessary to work carefully on the sales. In the case of real estate investments, the variables of greatest influence are the cost of the property, the interest rate, the cost of construction, the time for obtaining planning permission, the vacancy rate, the sales plan. The operating expenses, urban development costs, the intermediation and expenses techniques, taxation, etc. instead have a smaller impact on the results.

The sensitivity analysis, however, has some limitations:

- The need of a framework in which risk factors and the reachable level by the fundamental values, are clearly defined;
- Separate analysis of each variable does not take into account the fact that uncertainty acts simultaneously on several factors;
- The theoretical results of the analysis does not consider the probability of occurrence of events;
- An indication of the variability of the investment does not provide elements of choice.

Techniques such as sensitivity analysis and partitioning, identify only the "key" variables that mostly influence the results of the DCF, but say nothing about the reliability of the data used in the estimate, or rather, on the probability of occurrence of certain variations compared to the expected values.

7.5.2 Decision Tree Analysis

When the decision maker evaluates complex projects, the sequentiality and interdependence of the choices pose problems not related to the linearity inherent to the static NPV.

A project can in fact be described as complex or multi-step when its implementation is:

- Fragmented over time at different stages;
- Uncertain in terms of in and out cash flows;
- Conditioned by exogenous variables that have a temporary nature.

The Real Estate investing has these features and requires a structured decision-making process, based, on one hand, on the correct definition of the critical steps that significantly affect the performance of the project, and on the other, the understanding of the interrelationships that exist in decision-making moments in temporal sequence.

The approach drawn up by the Decision Tree Analysis is particularly suited to guiding the decision-making process of complex projects.[3]

The logic underlying the model implies that the structure of the project to be evaluated is translated into a flowchart called "decision tree".

Each branch of the tree is associated to the possible values that the project can take on as a result of certain hypothetical scenarios, to which specific probabilistic attributes are given. This analysis allows us to capture the interrelationships between decisions taken at different times and mutually dependent on each other. In fact, in the presence of a chain of mutually conditioned choices, where the proposed development at a given stage depends on the actions taken in the earlier stage, to identify the optimal sequence of decisions, one needs to work backwards, starting from the last branches of the tree.

In this way, it is possible to reflect on the "nodes" from which the different decision alternatives ramify. This approach is also known as "rollback method". The decision tree analysis defines an NPV that takes into account the possibility of managerial adaptability inherent to the project. This consideration will be dealt with later to introduce the topic of real options and the role of managerial adaptability/governance in contexts of uncertainty.

It is perhaps useful to premise that, although the decision tree analysis allows to reflect on the interrelationships between the various moments in the life of a project, this is done according to a deterministic approach. This approach requires that, at time 0, it must be possible to explain and calculate the consequences of such interrelationships.

In practice, if a project has two critical areas in terms of decision-making, since the latter depends on the outcome of the first product, the decision tree analysis requires that the result of the interaction is made explicit at the time of evaluation.

Structuring the project in the manner described implies that the cash flows, income and expenses are the only relevant parameters for decision-making. In other words, it is assumed that the decision maker is motivated by considerations of pure maximization of the monetary value of the project, which implies two often decisive considerations in reality:

- The tactical and strategic profile of the project is not directly included in the scheme of analysis;
- It is assumed that the decision maker is risk-neutral, which allows to exclude the consideration of the utility function compared to the investor's cash flows, from the analysis.

Example 7.4 shows that an application of decision tree analysis in the decisions on a project that has the characteristics of complexity mentioned above, helps to understand the logic.

[3] About Decision Tree Analysis see: Magee (1964), De Ambrogio (1977) and Zaderenko (1970).

Example 7.4 Consider the case of a company that is planning the construction of a series of buildings with increased use of innovative plants.

One performed a preliminary market research to investigate the size and the evolution of the demand. The company proceeds with the design and promotion of the intervention. Uncertainty about the behaviour of potential users means that the construction activity is initially limited to a small number of buildings. The eventual success of the pilot project then pushes the company to expand production by investing in the completion of the project. The project is complex (as defined), and consists of the following phases:

Phase 1—At time T_0 the company commissioned a market research the cost of which is equal to €20,000.

Phase 2—Given the results of the research, the company decides whether to proceed with the project. The decision implies the beginning of construction of the first building. The total investment cost amounts to €1,000,000. The alternative is the abandonment of the project.

Phase 3—After one year from the start of pilot construction, having analysed the first sales figures, the company evaluates the potential response of the target.

If the sales figures are considered satisfactory, the construction of other buildings begins. This involves an investment estimated at €10 million. Alternatively, the company gives up the completion of the project.

Phases 4, 5, and 6—In the event that one decides to proceed, one has to formulate the assumptions regarding cash flows obtainable in the next 3 years, according to three different scenarios (optimistic 4/realistic 5/pessimistic 6). The project structure and its decision-making process are shown in Fig. 7.7.

The decision nodes are shown with a circle and are located at time 0, at time 1 and at time 2. Each node is associated to consequences in terms of cash flows, which take the form of outputs related to the first two nodes and revenue from time $t = 3$.

Two or more branches of the tree derive from each node, indicating the different possibilities that open up on the occurrence of certain hypothetical scenarios. This, as mentioned above, allows us to capture the sequence and interdependence of the decisions reached at different times.

Further task of the decision maker is to associate to each branch and then to each scenario the relative probability of the event. The sum of the probabilities associated with the branches that arise from the same decision node is of course equal to 1.

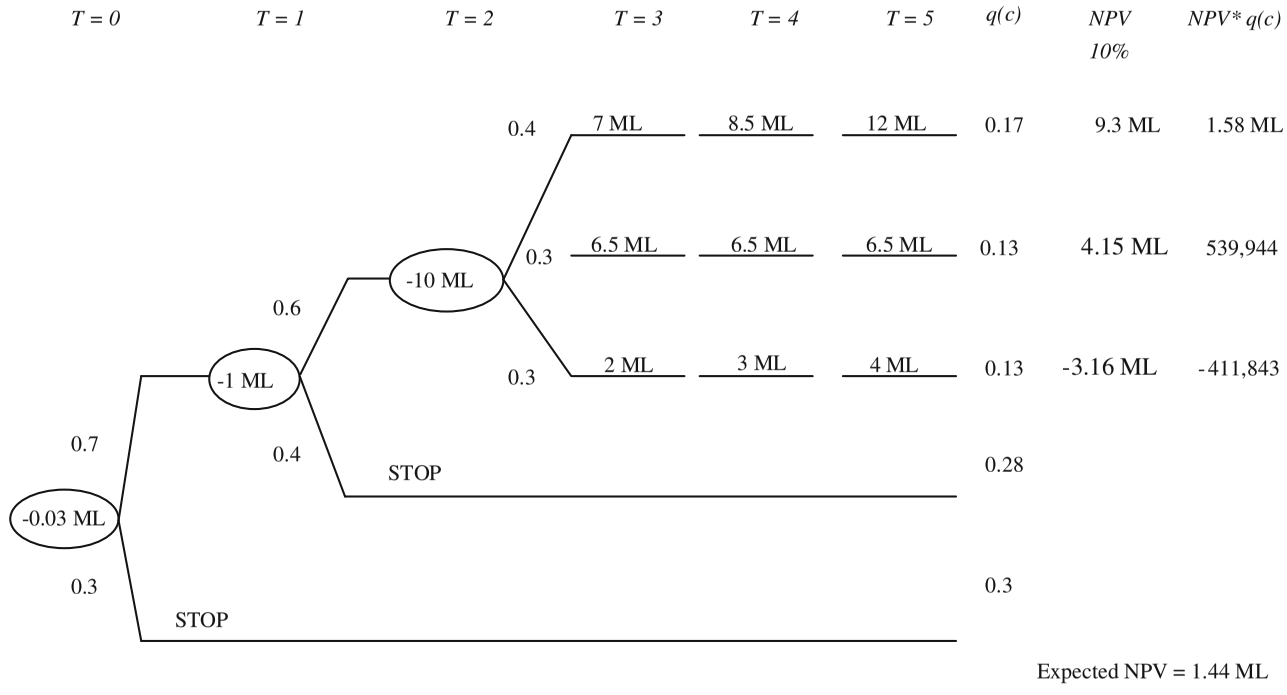


Fig. 7.7 Decision tree and calculation of PV

Entering into the calculation of the present value of the project, the first step is to determine the joint probability associated with each event (third last column of Fig. 7.7).

The sequence of events most favourable to the company is assumed: the market research provides a positive response for the project (q = 70 %); the experimentation on a limited number of buildings shows a high number of units sold compared to expectations (q = 60 %); expanding production, the company makes a more optimistic sequence of cash flows (q = 40 %).

The probability of occurrence of the whole sequence is equal to the joint probability of the different events that compose it, i.e. to the product of the simple probabilities:

$$q(c) = q(1) \times q(2) \times q(3) \times \ldots . \times q(n)$$

where:

$q(c)$ joint probability, or the probability of occurrence of the entire described sequence of events;
$q(t)$ simple probability related to the event tth, as t varies from 1 to n;
n number of events.

In this case it will be:

$$q(c) = 0.7 \times 0.6 \times 0.4 = 0.17$$

Therefore, the probability that from the beginning of market research the most favourable sequence of events for the company will take place, is 17 %.

The penultimate column of Fig. 7.7 shows the calculation of the NPV for each of the 5 sequences of events that may occur. With reference to the most favourable sequence, regardless of the role of chance, its NPV is calculated by discounting the cash flows related to single events (−30,000; −1 ML; −10 ML, 7 ML, 8.5 ML, 12 ML) that make up the sequence by an appropriate discount rate of 10 %. The NPV is equal to 9.3 ML. The same procedure is repeated for all other scenarios.

The last column of Fig. 7.7 is dedicated to the calculation of the expected overall NPV, of the project. The values of NPV, calculated for each sequence of events, are weighted for the joint probability relating to the same sequence.

The algebraic sum of the weighted NPV, thus provides the expected value of the entire project, amounting to 1.44 ML.

This result suggests to proceed with the implementation of the project. However, some observations are necessary. The range of variation of possible values of NPV appears to be very wide, which indicates a high

variability of the results. It should also be emphasized that there is an overall joint probability of $0.13 + 0.27 + 0.30 = 0.7 = 70\ \%$ that the project could lead to a negative result. In other words, the apparent opportunity to proceed with the investment could be contradicted by the consideration of a low risk appetite of the decision maker.

The principal advantage attributable to the decision tree analysis is the opportunity to express the structure of the project through a chart that highlights the fundamental key steps (nodes). The methodology in question should be seen as a first attempt to introduce, the concept of strategic analysis into the traditional methods of capital budgeting.

The attempt remains unfinished. In fact, the limit that this approach does not exceed consists in the necessity to explain the probability distribution of the scenarios that characterize the different expected results, which leads the latter within the methods of evaluation of the deterministic type.

7.5.3 The Monte Carlo Simulation

In the previous paragraph, it was shown the usefulness of the decision tree analysis in the case of valuation of investments with a strong interrelation between the decisions taken in different moments of the life of the project. In such circumstances, the application of the traditional formula of the static NPV, could require to make some simplification to the structure of the decision-making process of a size that radically changes the meaning, and therefore the informative extent of the result.

Another type of investments, difficult to fit into the logic of the static NPV, consists of projects characterized by strong uncertainty about the values of a number of parameters that are considered relevant.

Although it is possible to associate a given probability distribution to each of these parameters, it can be difficult to estimate directly all possible combinations of values that the various parameters may assume as a consequence of their respective probability distributions. This will prevent us from associating a probability distribution to the different results generated by the project as a whole.

Consider now the case in which the decision maker is faced with the problem of estimating the expected cash flows from an investment, and the uncertainty concerns both the determination of cash flows and of the capital necessary for beginning the project.

Although the decision maker is in a position to assign probabilistic weights to the values of each of the three parameters considered individually, this is not sufficient to determine the expected NPV of the project. The three parameters to be estimated can vary simultaneously within the predetermined range of values. In

such circumstances, the problem is therefore to make a probability distribution of possible values of NPV explicit, in light of the combinations that can be generated between the probability distributions associated to the key parameters.

The approach of Monte Carlo simulation allows to afford the problem, simulating a statistically high number of possible combinations of the values that key parameters may take as a result of the attribution of certain probability distributions. Each of the combinations is randomly generated, but in respect of the probability distribution assigned to each variable, it gives rise to a particular NPV. After associating the relative frequency to each NPV, it is possible to construct a given probability distribution of the NPV, and to determine the net present value expected for the project.

The steps for the application of Monte Carlo simulation in the economic evaluation of real estate investment are summarized as follows:

1. *Definition of the relevant parameters*

The first step is to identify the critical variables that have an impact on the overall result of the project. The selection of variables may be carried out by the sensitivity analysis, which aims to highlight the sensitivity of the result to the total variation of input parameters of the analysis, including the level of revenue, monetary operating costs, weight of taxation, the initial outlay required to implement the project and future cash receipts (or payments) related to the sale of the assets.

2. *Definition of the result to be reached*

It is about to mathematically explicit the formula or the model that allows to determine the outcome of the project to change the input deemed relevant.

For example, assuming that the cash flow of the operating management is the only parameter considered to be significant (or deemed by the sensitivity analysis) for the purposes of the possible impact generated on the configuration of result, and with reference to the application of the approach of the NPV, one can use a configuration of this type of parameter:

$$FC_t = FC + / - \Delta_{FC}$$

where:
CF net cash flow tax consequences;
Δ_{CF} change in the level of cash flow.

In this formula, for the year 0 it will also be necessary to subtract the initial required investment.

3. *Attribution of probability distributions*

For each of the selected parameters it is necessary to determine a range of values which are thought to occur, and these values must therefore be accompanied by probabilistic attributions, so as to define the complete probability distribution for each variable in the model.

4. *Launch of the simulation*

By using a processor, one generates a series of random numbers, each of which is associated with a particular value of the relevant parameters. If the relevant parameters are three, the first random number calls into question a particular value of the first parameter, the second random number calls a value of the second parameter, and so on. The first three random numbers generate, therefore, one of the possible combinations of values of the three parameters. Through this combination, it is possible to determine the first value of NPV generated by the simulation. Repeating the generation of the series of random numbers it follows the determination of a high number of NPV, each of which is characterized by a determined frequency, both absolute and relative.

Clearly, once the probability distribution of the NPV is constructed, it is possible to determine the expected value using the formula:

$$NPV_{Expected} = \sum_{t=1}^{N} (NPV_t \times RF_t)$$

where:

NPV_t tth value of NPV generated by the simulation;
RF_t relative frequency associated;
N number of simulations.

The Monte Carlo simulation solves all those evaluation problems where the large number of variables that characterizes the value of the project prevents an organic consideration of the possible combinations of value that the variables can take. Therefore, the simulation develops the probability distribution of a given function or objective outcome one wants to achieve, based on the consideration of a large number of possible combinations between the different values that the individual variables take.

The limit of this method is the need to explain the probability distributions of the individual variables included in the analysis, and thus to introduce into the evaluation, as is the case in the Decision Tree Analysis, a high dose of subjectivity.

7.6 Mathematical: Statistical Criteria

The cornerstone of traditional methods of risk control lies in the ability of the analyst to draw a "subjective" judgment about the riskiness of investment opportunities. In fact, even the probabilistic approach remains subjective when the probability distribution of the scenarios that characterize the different expected results is not based on historical data, but on the individual opinion of the analyst. Although in real estate one normally operates on the basis of subjective probability distributions—not having time series data able to build, through statistical

techniques, objective distributions—the analytical formalization of such distributions still allows to manage the risk with mathematical and statistical methods.

The risk associated with the forecast of cash flow is defined as the probability of having discrepancies between actual and expected outcomes, or in other words, the measurable possibility of an error with respect to the most likely outcome. This definition is the starting point for the modern risk analysis. It allows us to express the perception of risk in numerical form, i.e. through summary measures that respond to two fundamental questions:

1. What is the value of central tendency valid for the entire project?
2. What is the "quality" of performance determined in terms of risk, or offset and dispersion of the values around the value of central tendency?

The first question requires the determination of the average expected return; the answer to the second question is given by the introduction of statistical measures of dispersion, formed by the variance and standard deviation.

The average expected rate of return may be calculated using the following formula:

$$E(R_x) = \sum_{s=1}^{n} P(s) \times R_{xs}$$

where the symbols have the following meanings:

$E(R_x)$	average expected return of the project X;
s	scenario;
n	total number of forecast scenarios;
$P(s)$	probability associated with each scenario;
R_{xs}	rate of return of the project x at the occurrence of the scenario s.

The expected average rate of return is a measure of central tendency of the different values that one expects the project to take on, it represents a summary measure that takes into account the different scenarios, in an appropriate way, and is therefore of utmost importance to assess the overall performance to be associated with the initiative.

The formula calculates the weighted average of the various returns that one thinks the project will generate; the weighting factor is constituted by the probability of the occurrence of the different scenarios.

Example 7.5 The probability distribution of the annual cash flows resulting from the development of a real estate project is presented in Table 7.10.

In the third column the most likely cash flow expected from the project ($CF_{average}$) is calculated.

The distribution presented in Table 7.10 is called discrete because the possible outcomes are limited only to six discrete values of the cash flows.

Table 7.10 Cash flows and associated probability

Expected cash flows (€)	Associated probability	Weighted average(€) (flows · probabilities)
125,000	0.04	5,000
150,000	0.16	24,000
175,000	0.30	52,500
200,000	0.30	60,000
225,000	0.16	36,000
250,000	0.04	10,000
	Total = 1.00	$CF_{average}$ = 187,500

Each of the values in the first column of the example identifies a particular expected scenario. The probability (second column) represents the measure of the verisimilitude that a given expected scenario can turn into reality. However, the scenarios identified in this way define the whole range of possible values that the project can take, since the sum of the probabilities is equal to 1. In other words, it is assumed that these six possibilities exhaust all possible outcomes associated with the project. This clearly cannot correspond to reality: a more truthful distribution should include all the intermediate values that Table 7.10 does not consider. That example is therefore a discretization of a continuous distribution of probability and represented by the curve in Fig. 7.8.

A scenario summarizes the adoption of certain assumptions concerning variables considered relevant to the project, and these variables results from the occurrence or not of certain, often external, events, with respect to the scope of the intervention. In the attribution of probabilities to different scenarios, the degree of discretionary decision-maker varies depending on two factors:

1. The availability of objective data on the occurrence of events that affect the appearance of the forecast scenarios;
2. The ability of the decision maker to use the data, linked in turn to the use of statistical tools able to synthesize the impact on the overall value of the project.

In order to reduce the uncertainty of the estimates, an analysis of historic performance with respect to projects that have a level of risk similar to that of the project to be evaluated, is often carried out. The objective is to arrive at a more objective estimate of the expected return associated with different scenarios that characterize the evolution of the relevant variables of an investment project.

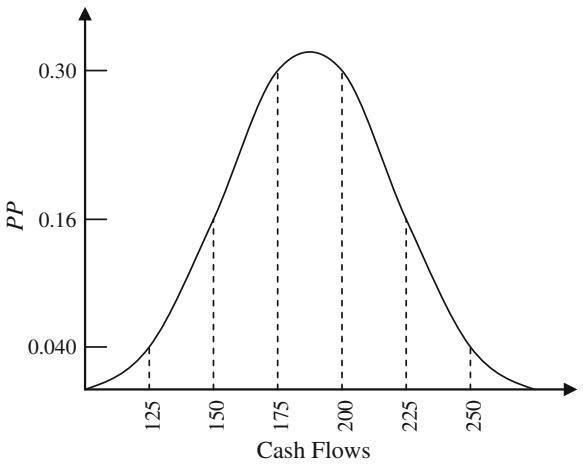


Fig. 7.8 Probability distribution of cash flows

The assumption of historical data for forecasting purposes, however, suffers a fundamental limitation on the hypothesis of constancy, even for the future, of the conditions of variability that have affected the returns of the project within the historical period of observation. If one assumed the uncertainty about the future is determined by new events and is different from those that characterized the historical performance of the project, it is certainly preferable to express the expected return of the project through a probability distribution that is subjectively determined.

If, on the other hand, there is trust in a certain constancy of the factors that have influenced the past performances, the historical data can provide useful information for the economic evaluation of the initiative, in which case the historical performance of project Y can be determined in the following way:

$$R'y = \sum_{t=1}^{N} Ryt/N$$

where the symbols have the following meanings:
$R'y$ average historical performance of project Y;
N number of observations;
Ryt rate of return of project Y in year t.

Example 7.6 Table 7.11 shows the values and the historical returns associated with project Y. The data was provided at the start of 2012 assuming that the value of the project is equal to 100.

In the example, the future value of the project is the result of a probabilistic estimate. The data for the project represents the performance

Table 7.11 Historical data relating to the project Y

Observations	Years	Values	Rates of return (%)
1	2012	100	2.04
2	2011	98	−2.97
3	2010	101	6.32
4	2009	95	1.06
5	2008	94	3.30
6	2007	91	7.06
7	2006	85	−3.41
8	2005	88	7.32
9	2004	82	10.81
10	2003	74	4.32
11	2002	71	1.43
12	2001	70	−2.78
13	2000	72	16.13
14	1999	62	6.90
15	1998	58	18.37
16	1997	49	4.26
17	1996	47	6.82
18	1995	44	4.76
19	1994	42	20.00
20	1993	35	9.38
	1992	32	

historically observed within a period of 20 years. For each observation the values that project Y took on at the end of the year, are associated. The rate of return for each year is calculated by dividing the annual change of the value of the project (final value − initial value) by the value taken on at the end of the previous year.

Referring to the data of Table 7.11 the historical average return is calculated:

$$R'y = 1.2103/20 = 0.060515$$

Performance history is therefore the average value of a time series. However, investment decisions cannot be separated from the joint consideration of the risk-

return profile, representing the risk as a parameter of "qualitative" discrimination of the performance associated with a given project.

The analysis of the returns must therefore be completed with the analysis of risk. Since the variability of returns is a synonym of risk, one must calculate the dispersion of estimated values around the value that expresses the central tendency.

The most commonly used statistical measures in this regard are the variance and the standard deviation. The variance measures the extent of variability or dispersion from the average of the measured/estimated values. It is given by the square of the standard deviation, which is the arithmetic average of the squares of the distances from their average values.

The higher the variance associated with the returns of an investment project, the higher the risk it is associated with. Variability is therefore a synonym of uncertainty.

The variance can be calculated both on the expected returns from a given project, and on historically observed values. With regards to the first case, the variance formula is the following:

$$E\left(\sigma_x^2\right) = \sum_{S=1}^{n} P(s) \times [Rxs - E(Rx)]^2$$

where the symbols have the following meanings:

$E(\sigma_x^2)$	expected variance of investment X returns;
s	scenario;
n	total number of scenarios;
$P(s)$	probability associated with the occurrence of scenario s;
Rxs	rate of return of project x at the occurrence of scenario s;
$E(Rx)$	average expected return of the project X.

That is:

$$\sigma_y^2 = \sum_{t=1}^{n} P(t) \times [Ryt - R'y]^2$$

with the following meanings:

σ_y^2	variance of returns of the project Y;
n	total number of observations;
Ryt	rate of return of project Y observed in period t;
$R'y$	average return of project Y.

The standard deviation (σ) is given by the square root of the variance, and it provides a measure of dispersion that is very useful when it comes to comparing investment alternatives whose cash flows are very different. Given that the variance and standard deviation provide coinciding information on the dispersion of

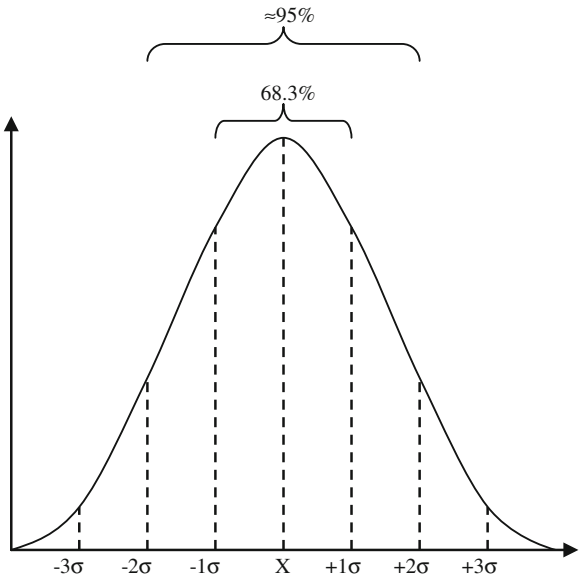


Fig. 7.9 Probability curve distributed symmetrically around the average (Gaussian)

returns of an investment around the average, the use of the standard deviation has the advantage of expressing the riskiness of the project in the same unit of measurement used to express the expected or observed values.

The standard deviation has mathematical properties that make it particularly useful. If the probability is distributed symmetrically with respect to the average (normal distribution or Gaussian), then 68.3 % of all possible values is within one standard deviation from the expected value, while two standard deviations comprise 95 % of the possible results (Fig. 7.9).

Once the average and the standard deviation are determined, the probability of occurrence of values included in a certain range can be calculated by referring to the table of standardized values in Table 7.12.

Table 7.12 shows the distance from the average (expressed in terms of standard deviation) of each expected value. The relationship is algebraically expressed as follows:

$$Z = \frac{X - \bar{X}}{\sigma_X}$$

where X is the generic value of a normal distribution, it is the central point of distribution (expected value) and σ_X is the standard deviation.

The expected value and standard deviation define the entire frequency curve of a normally distributed variable. If the distribution is not symmetrical, then it would be necessary to introduce other parameters that greatly complicate the problem.

The two parameters, expected return and expected variance, taken jointly, represent the measures used to properly express the risk-return profile. Then, by

Table 7.12 Normal standardized distribution

Number of standard deviations (Z)	Left or right area	Number of standard deviations (Z)	Left or right area
0.00	0.5000	1.55	0.0606
0.05	0.4801	1.60	0.0548
0.10	0.4602	1.65	0.0495
0.15	0.4404	1.70	0.0446
0.20	0.4207	1.75	0.0401
0.25	0.4013	1.80	0.0359
0.30	0.3821	1.85	0.0322
0.35	0.3632	1.90	0.0287
0.40	0.3446	1.95	0.0256
0.45	0.3264	2.00	0.0228
0.50	0.3085	2.05	0.0202
0.55	0.2912	2.10	0.0179
0.60	0.2743	2.15	0.0158
0.65	0.2578	2.20	0.0139
0.70	0.2420	2.25	0.0122
0.75	0.2264	2.30	0.0107
0.80	0.2119	2.35	0.0094
0.85	0.1977	2.40	0.0082
0.90	0.1841	2.45	0.0071
0.95	0.1711	2.50	0.0062
1.00	0.1587	2.55	0.0054
1.05	0.1469	2.60	0.0047
1.10	0.1357	2.65	0.0040
1.15	0.1251	2.70	0.0035
1.20	0.1151	2.75	0.0030
1.25	0.1056	2.80	0.0026
1.30	0.0968	2.85	0.0022
1.35	0.0885	2.90	0.0019
1.40	0.0808	2.95	0.0016
1.45	0.0735	3.00	0.0013
1.50	0.0668		

Table 7.13 Measures of dispersion

Expected cash flows (€)	Expected cash flow (€)	$CF_s - CF$ (€)	P(s)	$(CF_s - CF)^2 \times P(s)$ (€)
125,000	187,500	−62,500	0.04	156,250,000
150,000	187,500	−37,500	0.16	225,000,000
175,000	187,500	−12,500	0.30	46,875,000
200,000	187,500	12,500	0.30	46,875,000
225,000	187,500	37,500	0.16	225,000,000
250,000	187,500	62,500	0.04	156,250,000
			$\sum = 1.00$	V = 856,250,000
				σ = 29,262

measuring the ratio between the standard deviation and expected return, one gets a third key risk indicator: the coefficient of variation (CV). In symbols:

$$CV_X = \frac{\sigma_X}{R_X}$$

This coefficient expresses the amount of risk per unit of performance. The usefulness of this indicator, in particular, is due to the case where the decision maker must choose between alternative investment projects that have measures of expected return and standard deviation which are very different amongst each other. The use of CV makes it possible to classify the different initiatives according to a criterion of minimizing the risk considering an equal state of returns.

Example (continued) 7.6 In Table 7.13 measures of dispersion for the cash flows are calculated.

Figure 7.10 illustrates the results. The expected value of €187,500 is the midpoint of the distribution, and the 68.3 % of all possible values is included in the standard deviation (€29,262). Therefore, the real cash flow will be between €158,238 (187,500 − 29,262) and €216,762 (187,500 + 29,262), with a probability of 0.683.

$$CV = \frac{€29{,}262}{€187{,}500} = 0.156$$

Example 7.7 shows how one can incorporate the risk in the investment decision through the exploitation of probability parameters introduced.

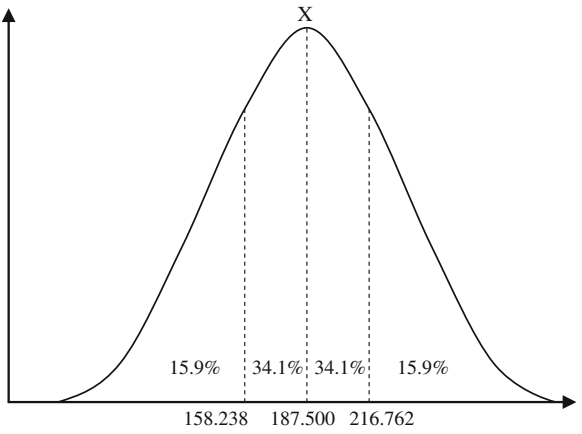


Fig. 7.10 The probability that the cash flow is included within $\pm 1\sigma$ from the average

Example 7.7 An investment project requires an initial outlay of €25,000. After 3 years, the investor expects to collect a net cash flow of €50,000. The standard deviation of the flow in the third year is estimated at €7,000, and it is assumed that the possible cash flows are symmetrically distributed around the expected flow. The income for the first 2 years of the holding period is void. The opportunity cost of capital for the investor is set at 10 %. Since it is assumed that the distribution of possible cash flows is symmetrical, the distribution of present values will be distributed symmetrically. The central point of the distribution of present values corresponds to the discounted value of expected cash flow.

$$\overline{PV} = \frac{\overline{CF}}{(1+i)^3} = \frac{€50{,}000}{1.10^3} = €37{,}566$$

It is also true for the determination of the standard deviation of the current value:

$$\sigma_{PV} = \frac{\sigma_{CF}}{(1+i)^3} = \frac{€7{,}000}{1.10^3} = €5{,}259$$

A present higher value than the current cost of initial investment (€25,000) means that the performance of the project exceeds the discount rate adopted (10 %). The probability of this happening is corresponds to the percentage of the area that is to the right of the point where the present value is €25,000 (Fig. 7.11).

The calculation can be done by entering the table of the standardized values with parameter Z, determined as follows:

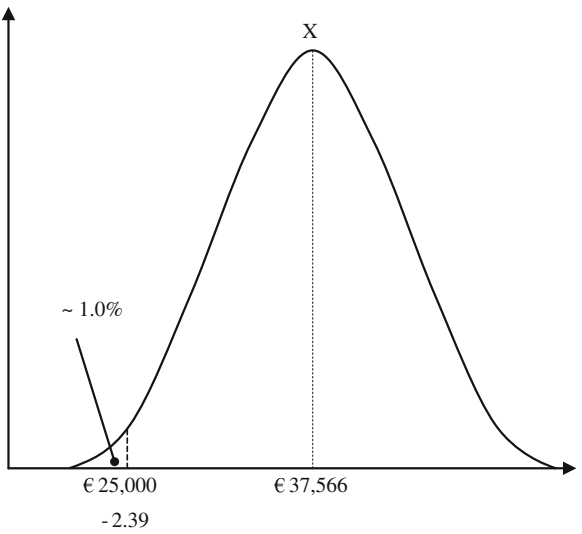


Fig. 7.11 The probability that the real present value of the initial investment proves smaller

$$Z = \frac{PV_x - PV}{\sigma_{PV}} = \frac{€25{,}000 - €37{,}566}{€5{,}259} = -2.39$$

where:
PV_x present value of the minimum acceptable;
PV Expected present value (arithmetic mean);
σ_{PV} standard deviation of the present value.

Table 7.10 indicates that the area to the left of PV = €25,000 corresponds to approximately 0.8 % of the total area underlying the distribution. The probability that this project generates at least a 10 % return is therefore greater than 99 %.

The expected value of the distribution of the indexes of profitability is calculated:

$$IP = \frac{€37{,}566}{€25{,}000} = 1.50$$

By specifying the maximum levels of acceptable risk for different values of the index of profitability, a risk profile that allows the evaluation of the project regardless of the initial financial commitment, is built. If the dispersion of possible outcomes indicates that the project is too risky with respect to the performance per

Table 7.14 Risk profile of two investors

	Acceptable probability that the index profitability is lower than 1	
Expected profitability index	Investor A	Investor B
0.0	0.0000	0.0000
1.2	0.0150	0.0150
1.4	0.0230	0.0260
1.6	0.0290	0.0345
1.8	0.0330	0.0430
2.0	0.0350	0.0460
2.2	0.0350	0.0490
2.4	0.0350	0.0500

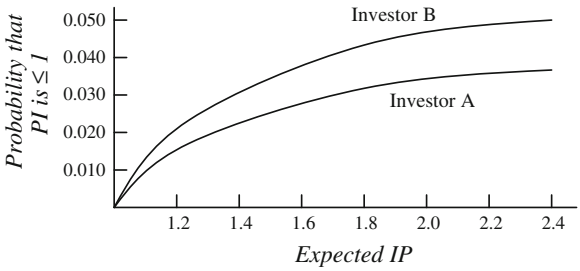


Fig. 7.12 Risk-return profiles

euro invested, then the opportunity is automatically discarded. Otherwise, the investor will take the final decision based on his strategies and on considerations regarding the management of the portfolio, the availability of capital, the legislative constraints, etc.

The construction of the risk profile (combinations of acceptable risk and expected returns) allows the investor to interface his personal attitude with the riskiness of the projects with the analyst's work.

Example 7.8 Table 7.14 shows the risk profiles of the two investors expressed in terms of probability of earning less than the minimum acceptable performance.

It is assumed that the cash flows have been discounted at the rate representing the minimum acceptable return for the individual investor. Thus, for a profitability index equal to 1.2, investor A will accept, at the utmost, a probability of 1.5 % that the real IP is lower than 1.

The higher the expected IP (i.e., the expected return), the higher the level of acceptable risk (Fig. 7.12).

Example 7.8 (not very close to a real condition especially in real estate) refers to an investment characterized by a single flow of incoming cash, placed at the end of the holding period.

In reality, the cash flows (positive and negative) will mature periodically for a certain number of years. It is therefore necessary to estimate the average and the standard deviation of cash flows for each of the years of the investment period. It is very likely that the revenues relating to the various annuities depend, at least in part, on what has happened in previous periods. This bond, defined as serial correlation, is measured through the coefficient of variation, a parameter between +1 and −1. When the coefficient of variation is zero, the cash flows are completely independent from each other, and if the coefficient is 1 or −1, then there is perfect correlation between the flows. In this second case, the deviation from the outcome is equal to the sum (financial) of the deviations related to all the years to come. The serial correlation does not affect the expected present value, but drastically alters the standard deviation of the related probability distribution. In general, the higher the degree of correlation between the annual flows, the greater the dispersion of possible outcomes around the average.

The standard deviation of the present value of a series of perfectly correlated cash flows (coefficient of variation = 1) is equal to:

$$\sigma_{PV} = \sum_{t=1}^{n} \sigma_{CF_t} / (1+i)^t$$

where

σ_{PV} is the standard deviation of the distribution of the present value;
σ_{CF} is the standard deviation of the distribution of the cash flows for the period t;
i is the discount rate used to obtain the expected present value.

With regards to the serial independence of cash flows, the present value does not change. Instead, its standard deviation is different. If the flows are completely independent, the deviation of the present value can be calculated using the following:

$$\sigma_{PV} = \sqrt{\sum_{t=1}^{n} \frac{\sigma_{CF_t}^2}{(1+i)^{2t}}}$$

where the symbols have the known meanings.

Table 7.15 Average and standard deviation of the expected cash flows

Year	Cash flows average	Standard deviation
1	€150,000	€54,000
2	€150,000	€45,000
3	€400,000	€90,000

Table 7.16 Average and standard deviation of the CF assuming perfect correlation

Years	Expected flows	×	Present value (i = 12 %)	=	Average present value
1	€150,000		0.8929		€133,940
2	€150,000		0.7972		€119,580
3	€400,000		0.7118		€284,720
					€538,240
Years	Flows standard deviations	×	Present value (i = 12 %)	=	Present value standard deviation
1	€54,000		0.8929		€48,220
2	€45,000		0.7972		€35,870
3	€90,000		0.7118		€64,060
					€148,150

The dependence between serial correlation and standard deviation is shown in Example 7.9.

Example 7.9 To launch a real estate development intervention, it is necessary to anticipate a capital of €500,000. The analyst develops the average estimation and standard deviation for the cash flows expected during the investment period (Table 7.15).

The distribution of annual cash flows is considered to be symmetrical and the correlation coefficient is assumed equal to +1. The minimum acceptable return for the investor is set at 12 %.

Table 7.16 calculates the average and the standard deviation of the present value using the formulas that are valid in the case of perfect correlation.

By performing the calculation under the assumption of fully independent flows, the standard deviation of the present value is:

$$\sigma_{PV} = \sqrt{\frac{(54{,}000)^2}{(1.12)^2} + \frac{(45{,}000)^2}{(1.12)^4} + \frac{(90{,}000)^2}{(1.12)^6}} = €87{,}846$$

Comparing this value with the standard deviation of the present value calculated in Table 7.16, it is obvious that, moving from a perfect correlation serial to a zero correlation, there was a reduction of €60,313 (−41 %) of the standard deviation of the present value.

When the cash flows are neither independent, nor perfectly correlated, then it is said that there is a partial correlation. In this case (certainly more in line with realistic conditions) calculations become complicated.

Help, in this sense, comes from a model developed by Hillier, which is particularly useful in the field of real estate investment (Hillier 1963). The approach is to group the annual cash flows according to their degree of correlation. Basically, a first group of flows is characterized by a very strong correlation, and a second group of flows is characterized by a near zero correlation. The two groups are then treated as if the corresponding flows were completely independent and perfectly correlated.

The present value of the segmented income flows is not affected by the changes introduced by the Hillier model, while the standard deviation formula takes the following form:

$$\sigma_{PV} = \sqrt{\left[\sum_{t=1}^{n} \frac{\sigma_{CF_t}}{(1+t)^t}\right]^2 + \left[\sum_{t=1}^{n} \frac{\sigma_{CF_t}^2}{(1+i)^{2t}}\right]}$$

where the first calculation is applied to the cash flows considered as perfectly correlated, and the second calculation is applied to the flows considered to be independent.

Example 7.10 To improve risk assessment, the analyst decides to separate the projections of the cash flows of Example 7.9, dividing them into inputs and outputs. Because rents are heavily dependent on residential factors, it is assumed that these revenues are highly correlated over time. The same also applies to the selling price of the property at the end of the holding period.

The operating expenses, however, are not normally influenced by location factors: it is expected that they vary with respect to the projections, only based on random events. If it is assumed that costs are serially independent and revenues perfectly correlated, this condition can be summarized in Table 7.17.

The expected present value of investment remains unchanged from Example 7.9:

Table 7.17 Cash flows and standard deviations

	Planned revenues (€)		Planned expenses (€)	
Year	Revenues	Standard deviation	Expenses	Standard deviation
1	270,000	37,800	120,000	16,200
2	270,000	35,000	120,000	10,000
3	520,000	60,000	120,000	27,000

$$PV = \frac{150{,}000}{1.12} + \frac{150{,}000}{1.12^2} + \frac{150{,}000}{1.12^3} = €538{,}220$$

The standard deviation of the expected present value, however, takes a very different value. Applying the formula of Hillier the standard deviation is:

$$\sigma_{PV} = \sqrt{\left[\frac{37{,}000}{1.12} + \frac{35{,}000}{1.12^2} + \frac{60{,}000}{1.12^3}\right]^2 + \left[\frac{(16{,}200)^2}{1.12^2} + \frac{(35{,}000)^2}{1.12^4} + \frac{(27{,}000)^2}{1.13^6}\right]}$$

7.6.1 The Average-Variance Approach

Average and variance are two important parameters with which one can proceed for the financial evaluation of investments when the uncertainty of the expected cash flows can be quantified by defining their probability distribution. Example 22 shows an application of the criteria for the measurement of risk previously described in the traditional formulation of NPV.

The approach of the average-variance theorizes that between two investment strategies, the one that has a higher expected return and a minor standard deviation should be preferred.

Example 7.11 Suppose one has two alternative investment projects, A and B, the expected cash flows of which represent variables in three alternative scenarios (Table 7.18). Assuming a weighted average capital cost of 11 %, one has to proceed to the determination of the different values of NPV in order to achieve a forecast of the different scenarios. Based on these, it appears that each of the two projects is associated with three possible NPV values, provided with relative probability distribution. Each project can therefore be dealt with, by using tools of average and variance.

Table 7.18 Expected values for projects A and B based on the hypothesis of three different scenarios

Projects	Scenarios	Probability	F_0	F_1	F_2	NPV
A	Pessimistic	0.2	−100	30	40	−40
	Normal	0.5	−100	50	70	2
	Optimistic	0.3	−100	80	100	53
B	Pessimistic	0.3	−100	30	50	−32
	Normal	0.4	−100	60	60	3
	Optimistic	0.3	−100	80	80	37

Based on the previous formula, replacing *Rxs* with the *NPV* associated with the different scenarios for project A, the expected *NPV* is equal to:

$$NPV(A) = -40 \times 0.2 + 2 \times 0.5 + 53 \times 0.3 = -8 + 1 + 15.9 = 8.9$$

and the standard deviation is equal to:

$$\sigma_{PV}(A) = \sqrt{\left[(-40 - 8.9)^2 \times 0.2 + (2 - 8.9)^2 \times 0.5 + (53 - 8.9)^2 \times 0.3\right]} = 32.9$$

With regard to project B instead:

$$NPV(B) = -32 \times 0.3 + 3 \times 0.4 + 37 \times 0.3 = -9.6 + 1.2 + 11.1 = 2.7$$

$$\sigma_{PV}(B) = \sqrt{\left[(-32 - 2.7)^2 \times 0.3 + (3 - 2.7)^2 \times 0.4 + (37 - 2.7)^2 \times 0.3\right]} = 26.7$$

Summarizing, therefore:

Project	Expected NPV	σ_{PV}
A	8.9	32.9
B	2.7	26.7

As one can see from the table, investment project A has an expected NPV higher than that of B. The data relating to investment risk, however, is in

favour of project B, since the standard deviation of the expected NPV is equal to 26.7, lower than project A.

The average-variance criterion asserts that individual preferences are characterized only by these two parameters. Individuals prefer the alternative which has a higher expected return at a constant risk or, alternatively, a minor risk equal to the expected return.[4] The problem of Example 7.11, with reference to the illustrated approach, does not, therefore, identify, a preferable solution.

The choice between investment A and B requires the consideration of the degree of aversion to risk of the investor. This is possible through the construction of a utility function.

7.6.2 The Expected Utility Theory

Among the psychological models of human behaviour, the theory of Expected Utility represents a fundamental model at least within the framework of the classical decisional theory.[5] This model, based on the theory that the operator is rational and predictable in his actions, was born at the end of the '40s (Von Neumann and Morgenstein 1974). It has been widely applied as a model of economic behaviour, at least until new theories overcame certain limits and properly integrated psychological aspects of individual assessment within the analysis as a whole [e.g., the theory of the Prospectus (Kahneman and Tversky 1979)].

Fundamental to this model is the assumption of rationality underlying the behaviour of individuals. This theory, in conditions of uncertainty of the result to achieve, i.e. risk,[6] defines' "utility" as the cardinal measure of consumer preference. The assumption of rational behaviour leads to the hypothesis that individuals in reality, move according to predetermined patterns based on the fact that they always prefer to have a greater wealth than a minor and therefore the marginal utility of wealth (in this case the NPV) is always positive.

The model postulates that the decisions of economic operators conform to a function of expected utility that is able to bind a corresponding measure of utility to each choice. The model can be used for classifying risky alternatives: the

[4] It should be noted that an investor could be defined as "rational" when its process of resource allocation is based on the principle of maximizing the return on an equal risk, or risk minimization, given an equal level of expected return.

[5] Usually, the models of decision theory, which reflect the main points of the economic outlook, are identified in this context.

[6] The individual is called upon to make a decision without knowing with certainty, ex ante, what may happen in the world, but he knows the list of possible events, to which he associates a probability of occurrence.

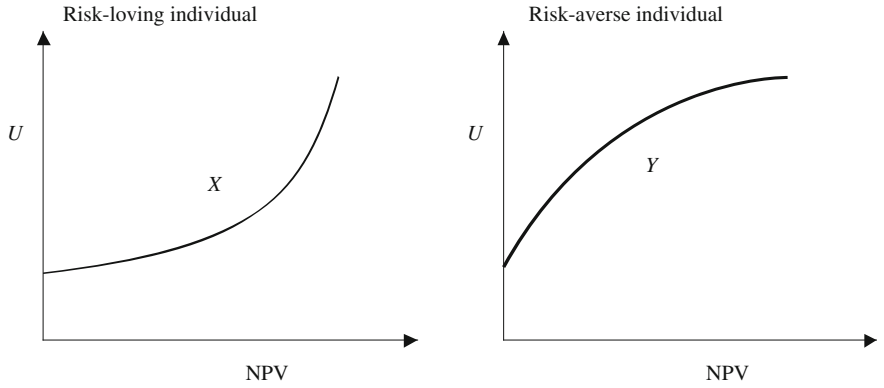


Fig. 7.13 Utility functions—NPV

measure of utility assigned to each alternative is expressed as a function of the possible results and the probability that these results occur. The individual will choose the alternative associated with the highest expected utility.

The utility function can have different forms (Fig. 7.13) according to the perceived risk by the investor:

- It is concave when describing the preferences of a risk-averse individual (Y);
- It is convex when describing the preferences of a risk-loving individual incline (X);
- It is linear when describing the preferences of a risk neutral individual.

The utility function can be considered as an immediate derivation (or vice versa) of the indifference curve, already defined as the set of points that identify combinations of risks and returns that are indifferent for the investor.

The inclination of an indifference curve expresses the degree of aversion to risk that the investor has. The higher the inclination, the higher the required risk-return substitution rate. In other words, at an increase in the inclination of the curve, the investor will be willing to take on increasing amounts of risk on condition that the returns achieved are proportionately higher.

The concept of "risk premium" is also attributable to the utility theory, where "risk premium" is defined as the maximum payment that the individual is willing to pay to eliminate risk and obtain the expected gain from the risky condition[7] with certainty. In other words, the risk premium measures how much the individual is willing to pay to eliminate the risk of choice. This concept is reminiscent of the certainty equivalent, which instead represents the willingness to accept a sure amount in lieu of a higher uncertain gain resulting from a risky investment. The

[7] Wikipedia defines it as the minimum amount of money by which the expected return on a risky asset must exceed the known return on a risk-free asset, or the expected return on a less risky asset, in order to induce an individual to hold the risky asset rather than the risk-free asset.

risk premium (RP) is in fact measurable as the difference between the expected value (EV) and the certainty equivalent (CE):

$$PR = EV - CE.$$

A risk-averse investor will exhibit a positive risk premium, then the higher the premium, the higher its level of risk aversion.

According to this approach for each possible outcome (*NPV*) of a project, a value based on the investor's utility function *U*(*NPV*) is assigned. The expected utility is obtained as the weighted average of the utility associated with each possible outcome, with the weight determined by the respective probabilities.

The construction of the investor's utility function allows one to measure the certainty equivalent, but above all, it allows for an intra-project comparison. In practice, according to this theory, if called upon to choose between several alternative projects, an individual will compare the levels of expected utility *EU* associated with the various alternatives and will choose the one with the highest expected utility.

The expected utility theory is based on certain axioms thanks to which the underlying logic of decision-making behaviour is greatly simplified. It assumes that individuals are perfectly rational and act using complete and homogeneous information sets. These assumptions allow a simple mathematical modelling of the decision-making process based on some external constraints. On the other hand, as already mentioned, the empirical research and the study of the psychological processes of judgment and decision-making have shown that investors systematically make errors, of reasoning and preferences, which are difficult to reconcile with the assumption of rationality behind the choices made.

Furthermore, there is the operational limit related to the need to clarify the utility functions of the investor.

Example 7.12 For investment Z two possible scenarios are expected: one with NPV = 20 (pessimistic) and the other with NPV = 80 (optimistic) to which exactly the same probability is associated (0.50).

The expected value of the NPV is $= 20 \times 0.50 + 80 \times 0.50 = 50$.

If the investor's utility function is like that of Fig. 7.14 which highlights an aversion to risk, the expected utility corresponding to the pessimistic scenario is 30, while it is equal to 55 in the event of an optimistic scenario. The expected utility is then equal to

$$EU = 30 \times 0.50 + 55 \times 0.50 = 42.5$$

Instead, the utility associated with the expected value is equal to 47, i.e. greater than *EU*.

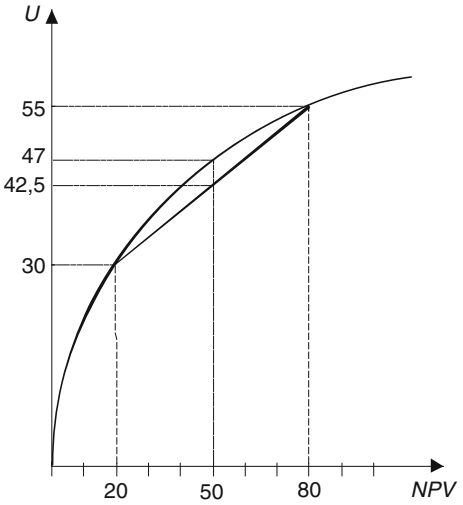


Fig. 7.14 Examples of utility functions—NPV

Table 7.19 Cumulative function of the probability of (S)

NPV	Probability	Cumulative function
10	0.2	0.2
12	0.25	0.45
15	0.3	0.75
18	0.15	0.90
20	0.1	1

Table 7.20 Cumulative function of the probability of (T)

NPV	Probability	Cumulative function
10	0	0
12	0.1	0.1
15	0.5	0.6
18	0.2	0.8
20	0.2	1

The certainty equivalent is the *NPV* that is achievable without any risk. It gives the investor a utility equal to that expected from the risky project under consideration.

In the example the certainty equivalent is measured from the vertical that intersects the utility curve with the value 42.5: $EC = 41$. The risk premium is equal to $\mathrm{RP} = 50 - 41 = 9$. Since, as in the example, a positive risk premium characterizes the risk aversion of the investor, it is clear that this kind of attitude is represented by a concave utility function.

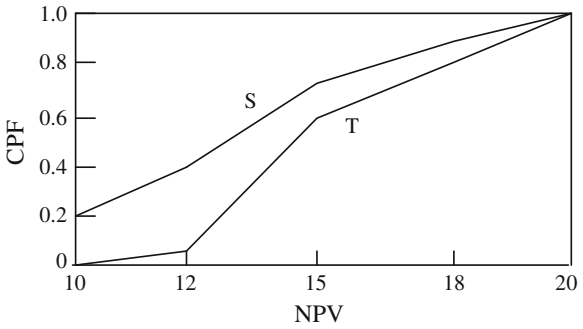


Fig. 7.15 Cumulative functions of probability of the projects (*S*) and (*T*)

7.6.3 The Approach of Stochastic Dominance

The mathematical derivation of utility functions can be overcome by using the concept of stochastic dominance.

There exists a stochastic dominance in a project (A) with to a project (B) when the level of utility derived from A is greater than the level of B for any amount of expected result of the project. Instead of deriving the mathematical structure of the utility function, it is therefore necessary to verify some basic characteristics. Firstly, it is necessary to represent the values of NPV using the Cumulative Probability Function (CPF). This function indicates the probability that the NPV is equal to or lower than a certain value. Analytically, the CPF is derivable by summing the probabilities expressed as relative frequencies of the values of NPV.

Example 7.13 Tables 7.19 and 7.20 show the probability distribution of NPV relating to projects S and T. The respective cumulative probability functions are shown in Fig. 7.15. As is clearly seen in this figure, the cumulative function of the probability of T is always to the right of that of S. This means that for each level of NPV, the project (T) with respect to (S) has a lower probability and that its value is less than the identified NPV.

For example, if one considers the NPV threshold of 15, project (T) has a 60 % chance of a total value lower than this level, compared to 75 % of S. In such circumstances, regardless of the derivation of the utility function of the decision maker, it can be said that project (T) stochastically dominates project (S), and so (T) is the preferred project. This case is known as the so-called first-degree stochastic dominance (Copeland and Weston 1992; Goodwin and Wright 1994).

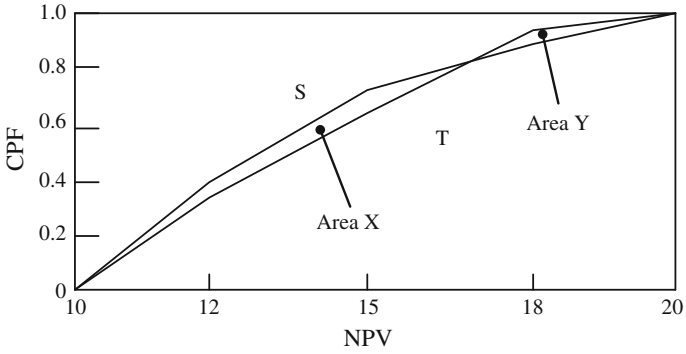


Fig. 7.16 Examination of a case of second-degree stochastic dominance

Consider now the case of two projects with cumulative functions of probability that intersect, for which there is no condition for stochastic dominance of the first degree. The situation is described in Fig. 7.16.

In this case, to verify the hypothesis of stochastic dominance it is necessary to consider both the extent of the NPV intervals in which a project partially dominates the other and the size of that domain.

A similar verification can be done by comparing the extent of the areas included between the two, respectively area X with area Y. The first area, in fact, shows the extent to which project (B) stochastically dominates project (A); area Y, on the other hand, indicates the dominance of (A) to (B). The examination of the graph clearly shows that area X has a greater extension than that of Y; this configures a hypothesis of stochastic dominance of second degree of project (B) on project (A).

Whereas the graphical analysis does not allow us to determine which of the areas is wider than the other, it is necessary to use the calculation of the integral, analytically determining the amplitude of the two areas. In the formula, for a risk-averse investor, project (A) stochastically dominates project (B) when the following condition occurs:

$$\int_0^{NPV_i} U_B(NPV)d(NPV) \geq \int_0^{NPV_i} U_A(NPV)d(NPV)$$

with the inequality settled in a strict sense at least for a NPV.

The latter case, which also regards stochastic dominance, has the same limitations of average variance. Only when one is in a clear condition of stochastic dominance is it not necessary to explain the utility function of the decision maker.

7.6.4 Evaluation Based on Differentiated Assumptions

It is an evaluation technique implicitly used in the illustrated examples, based on which one determines different values of NPV for each project to be evaluated, by following three basic hypotheses: pessimistic, optimistic, and maximum likelihood. The aim is to define the width of the spectrum of different possibilities that one imagines might occur. The evaluation based on differentiated assumptions differs from the sensitivity analysis because the latter acts in single mode on the different variables that determine the value of the project, while the former takes into account multiple scenarios within which a specific interaction between the different variables is assumed.

The fundamental limits of this approach are twofold. First, the spectrum that goes from the pessimistic assumption to the optimistic one is often so wide as to result ineffective for the development of guidelines for decision-making. Secondly, this method, in any case, leaves space to the subjective component of the decision maker, this limitation, however, is quite common amongst the evaluation methods discussed in this chapter.

7.6.5 Mathematical Programming

Mathematical programming is based on the expression of the results of the project to be evaluated through a mathematical function, called "objective", which relates to the main variables.

The function is associated with a set of constraints, represented by disequations that define the "area of eligibility" of the values associated to single variables or to groups of variables included in the "objective" function.

A problem of optimization of multiple function variables that are subject to constraints of non-linear disequations or equations, arises.[8]

This methodology is certainly rigid when considering the interrelationships between the single variables, but has the background disadvantage linked to the need to analytically express the relationships between the variables that explain the value of an investment project.

The formal rigidity is followed by a difficulty of application, as well as a lack of responsiveness to the typical structure of a decision-making process, which is similar to that which has been presented above.

[8] On this topic, refer to Comincioli (1990).

7.7 Limits and Perspectives of Evaluation Techniques

In view of the traditional capital budgeting an investor faced with options/alternative projects, manages the decision-making process on the basis of an eminently economic nature, not being able to evaluate his choices in relation to the consistency of them with the business strategy.

The NPV for example, (a crucial tool of capital budgeting) responds well to the question of whether it is appropriate to spend today, or invest savings in order to spend more in the future. Its genesis is an instrument for the evaluation of investments in the context of relative certainty (in the risk free version) and its fundamental insight is that of the financial value of time. To this the advantage of simplicity that made this tool easily applicable to many different contexts, must be added. The limitations on the use of the NPV are related to the lack of consideration of the risk factor. The management of the risk factor is essential and unavoidable in real estate, unless it has to deal with, as often happens, a committed project (or build-to-suit project) implemented in a context of relative certainty. In all other cases it is necessary to introduce the assumption of uncertainty, or to imagine that, in line with what happens in reality, most real estate investments generate cash flows that are uncertain both in terms of the entity and in terms of temporal manifestation.

Several techniques based on the discounted cash flows that can influence the risk in the evaluation process, have been illustrated.

The DCF analysis, in its static version, calculates an NPV by modifying the denominator of the formula, the discount rate k (which reflects the concept of opportunity cost of capital) given by the sum of a risk-free rate (r) and a premium for the risk (p).

Rate k therefore expresses a subjective risk factor. This step is one of the main reasons why this approach is criticized. Another critical issue is that relating to the adoption of a constant discount rate in projects whose risk profile appears variable during the implementation phases. In the case of construction of a building, for example, the first steps involve a risk that is definitely higher than in the latest phases. These problems affect the sustainability of the results and therefore the efficacy of using this methodology. As a result, the investors will turn to the application of discount rates, constant but very high, based on subjective estimates and not always justified.

Exceeding this limit occurs with the use of a probabilistic approach to risk analysis. It is true, however, that the fundamental prerequisite for the beginning of a probability analysis is the availability of a sufficient number of cases to allow the construction of a frequency distribution for the single key variables. However, the difficulty of collecting data and information in an inefficient and non-transparent market such as real estate is known, especially in Italy. This is the main reason for which the probabilistic analysis, when it is carried out, is often developed from subjective probability distributions; in other cases, the use of traditional techniques is preferred.

The limit of NPV that even a probabilistic approach to risk analysis is able to overcome, is given by the impossibility to incorporate feedback of a strategic nature in contexts of uncertainty, that take into account the interaction between current investment alternatives and future decisions.

A decision is defined as strategic when it has a long-term horizon, it is irreversible, and it can deeply modify the outcome of the investment. An investment that provides, in its development, choices of this kind is often the bearer of a wide area of value in itself, which is difficult to quantify using traditional approaches of capital budgeting. It can therefore be said that the strategic analysis takes care of all those decisions that ensure the achievement of long-term objectives, while the capital budgeting techniques provide the tools needed to measure the impact that decisions can cause.

Traditional DCF approaches allow to choose between investment alternatives that are homogeneous in terms of strategy, and those that differ in risk, in the amount and in the temporal distribution cash flows. Very often, however, developments related to an investment decision are such that they can only be evaluated at a later stage. These are investments that are broken down into several, temporally consecutive segments, whose value depends on the outcome observed in the previous segment.

There are two cases of dependence that can derive from a project:

- Temporal interaction: it refers to the consequences that a project generates in the future on itself, i.e. the interaction between current decisions and future opportunities, in a context of environmental uncertainty;
- Design interaction: concerns the relations generated between the actions and decisions taken in relation to a specific project and the consequences related to the implementation or the evolution of other projects.

Both the temporal interaction and design interaction have a common root in the concept of adaptability/managerial governance of the project.

Adaptability is intended for all changes which may affect the project, depending on the future market or industry, and that may be the subject of a decision by the management. The adaptability seems to well epitomize the levers available to the investor, and ultimately the strategic dimension of a project.

Consider, for example, the possibility of delaying the construction of a building in relation to the possible intervention of adverse conditions. In this regard, it is necessary, firstly, to reflect on the fact that if time has a financial value, rightly considered by the NPV, it also has an informative value. The informative value of time is a resource of great importance in all those areas where rapid technological and competitive evolution requires a dynamic management.

This leads to assign a particular value to those projects whose implementation may be delayed, without compromising their feasibility. In such circumstances, in fact, the investor can alternatively avoid taking a wrong decision or optimize the implementation of the project in light of changed strategic-competitive scenarios.

The reasons for dissatisfaction with the traditional tools of capital budgeting are rooted in their inadequacy for evaluating investment projects characterized by

decisions dependent on the outcome of uncertain variables and the consequent possibility/necessity of an intervention by the investor, after the implementation of the project.

Ultimately, it is possible to conclude that the NPV does not allow to weigh the strategic importance of investment decisions, and this mainly because it is not able to take into account the interaction between current investment alternatives and future decisions.

When an investor decides to produce a very innovative building in an area that has not yet been exploited, the result of the investment cannot be searched in the cash flows that are directly generated by the initiative itself. In such circumstances, in fact, the value of the investment lies mainly in the future opportunities it may open.

As a rule, it is possible to say that the purpose of many strategic investments is to collect information about a particular product or market. Just as a construction company finances market research aimed at estimating the absorption capacity of a given segment of potential users, they can also develop a pilot project, the costs of which are known but the expected benefits are uncertain.

Even in the case where the NPV of the basic investment is negative, the investor can still proceed with the operation if estimates that the value of future opportunities justify the initial sacrifice incurred in order to acquire them.

In many cases, the logic of the NPV must therefore be corrected so as to take into account the creation value represented by the managerial flexibility implicit in the initiative itself.

References

Comincioli, V. (1990). *Analisi Numerica*. Milano: McGraw-Hill.

Copeland, T. E., & Weston, J. F. (1992). *Financial theory and corporate policy* (pp. 92–101). Boston: Addison Wesley.

De Ambrogio, W. (1977). *Programmazione reticolare*. Milano: Etas Libri.

Fiedler, L. E., & Janda, M. D. (1993). The elements of a real estate investor's aspired rate of return. *Real Estate Review, 23*(1), 42–48.

Goodwin, P., & Wright, G. (1994). *Decision analysis for management judgment* (pp. 140–143). Hoboken: Wiley.

Hillier, F. S. (1963). The deviation of probabilistic information for the evaluation of risky investments. *Management Science, 9*, 443.

Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica, 47*(2), 263–291.

Kelly, J.R. (1984). *A method for the formulation of a cost database for use during the evolution of the sketch design of a building* (pp. 10–19). CIB W55 1984-I.

Magee, J. (1964). How to use decision trees in capital investment. *Harvard Business Review, 42*, 79–96.

Von Neumann, J., & Morgenstein, O. (1974). *Theory of games and economic behavior*. Princeton: Princeton University Press.

Zaderenko, S. G. (1970). *Sistemi di programmazione reticolare*. Milano: Hoepli.

Chapter 8
The Theory of Real Options in Real Estate

Abstract The limits of discounted cash flow analysis in its static version, even when using a probabilistic approach to risk analysis, are given by the impossibility to incorporate strategic assessments, that is, to take into account the interaction between current investment alternatives and future decisions. The theory of real options outlined in this chapter, is an attempt to overcome this limitation. It discards the static approach and allows to manage the uncertainty related to possible changes of scenario. It is used to determine a final investment value in which the values of future opportunities that may arise for the real estate investor are included, such as expansion, contraction, abandonment or postponement of the project.

In the previous paragraph it was pointed out that the main limitation of the NPV—as traditionally understood—consists in the inability to evaluate between current investment opportunities and future decisions. This is crucial for strategic investment where the benefits from future developments resulting from the assumption of current decisions, may represent most of the value of the investment.[1]

It then becomes necessary to adopt models and logics of evaluation to assign a specific value to the discretion of the investor to administer an investment, among threats and opportunities that characterize future scenarios. This discretion has been defined as adaptability/flexibility management.

Investment projects in real assets should be seen as the source for a number of opportunities that lead the management, in changing from a passive to an active setting, to recognize the necessity of certain conditions in certain scenarios.

The opportunities for expansion, contraction, abandonment or postponement of the launch of an investment project give the decision maker a managerial flexibility whose value should be taken into account in the overall evaluation of the project.

[1] In practice it seems that many managers already realize that there is something wrong with the simple rule of the net present value (NPV) as it is commonly understood. That is, they become aware that the expectation of further information can create value and that this value is not reflected by the traditional calculation of the net present value…. It may happen that managers realize that the options of an enterprise are valuable and that it is appropriate to keep them open (Dixit and Pindyck 1994).

B. Manganelli, *Real Estate Investing*, DOI 10.1007/978-3-319-06397-3_8

The Real Options Theory is presented as an attempt to overcome the main limitations associated with the methods of risk treatment described so far. This approach describes a method which involves evaluating and managing strategic investment in an uncertain context and which extends the methods of option pricing from the financial contracts to the so-called real assets. The most interesting chance offered by this new theory is the ability to consider strategic evaluations, to quantify the risk related to consequences that result from future decisions based upon original design assumptions.

The real options analysis is a technique for evaluating investments that can be successfully used to deal with uncertainty related to possible changes of scenario.

Compared to the static approach—which considers the discounting of cash flows for investment in the most likely predictable future scenario—the real options approach, when it is possible to transform uncertainty into risk, allows for the risk analysis for different project solutions, to be carried out, namely, options.

In the real options theory, this is made with the concept of extended NPV (ENPV):

$$ENPV = NPV_b + OP$$

where

NPV_b net present value related to base investment, the evaluation is deterministic in this case, and the result does not consider future opportunities;

OP the value of future options.

The theory of real options, as mentioned above, means to evaluate an investment project with regards to opportunities offered to the investor and which may lead him to assume specific future conducts that are part of a broader concept of flexibility/adaptability. The cornerstones of the theory are:

1. Strategic investments are a source of real options;
2. The investor has the managerial flexibility/adaptability.

The real options approach, along with the evaluation methods regarding contexts of uncertainty, has the advantage of adapting to the characteristics of complexity that some investment projects have.

Through the theory of real options, the analysis of economic convenience of a specific initiative and the strategic considerations thus become a unique moment of reflection.

8.1 Investment as a Generator of Real Options

The evaluation of an investment project through the NPV is based on the formulation of assumptions related to their ability to be absorbed by the market, related to the cost of production, to credit policy and to the amount invested. This results in an expected cash flow that is discounted using an appropriate rate,

expression of the riskiness of the project. When one decides on the basis of the NPV, the project cannot be subject to change in any of the dimensions that make up its original structure. Furthermore one assumes that the investor, upon leaving the strategic vision, confines himself to implement the planned project, even if unexpected events may cause appropriate amendments to the project itself.

The NPV therefore does not take into account, that the investor is a manager of real assets, and consequently he is able to respond to market changes, to make strategic choices that will enable him to benefit from the positive scenario evolution, and at the same time to intervene to contain the negative consequences of an unfavourable evolution of the variables that affect the value of the project.

Investment projects incorporate real options which are exercisable by the investor at the most appropriate time. These options gain value the moment certain conditions and potentialities have been pin-pointed and are considered as realistic. This value should be reflected in the overall evaluation of the project. The problem is to define the tools for the options assessment.

The procedural process, which is based on the theory of the options, is subject to the following considerations:

(a) There is a problem of definition and recognition of the opportunities offered to the investor once he embarks on a given investment project or at the very moment of the assessment;
(b) These opportunities must be adequately evaluated for each of them providing the quantitative information necessary to their evaluation.
(c) When the types and numbers of the different options are clear, one needs to question the interrelations between the different options that arise from the same project (the problem of joint options requires special precautions in the evaluation phase);
(d) Finally, it is necessary to quantify the total value of the identified options, so it is necessary to use mathematical-statistical models that interpret the structural complexity of the project.

The fundamental elements that characterize an option are:

1. The deadline given by the validity timescale of the right to exercise an option;
2. The exercise price, which is the price to pay to apply the right;

As said, the evaluation of investment projects in an uncertain context involves the determination of many values of extended NPV as many as the number of scenarios resulting from the combination of the assumptions related to the development of the key variables of the project. The different values of NPV thus determined are represented through a frequency distribution, which can be associated with a specific probability function to be estimated, based on trust attributed to the different scenarios.

Figure 8.1 shows a possible probability distribution of the NPV of a project. In the absence of managerial flexibility i.e. real options, it is reasonable to assume that the distribution is normal (symmetric). This is actually an implicit assumption to the deterministic approach of the static NPV.

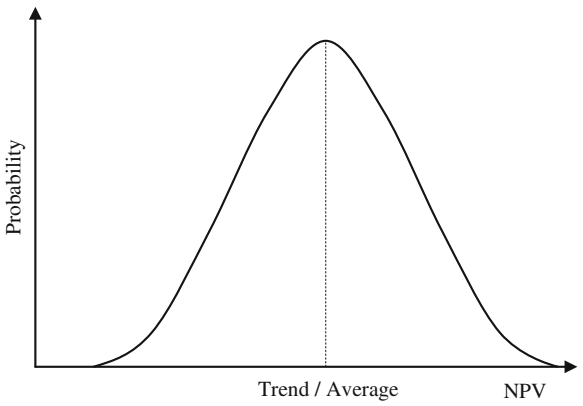


Fig. 8.1 Distribution of probability of the NPV of a risky project, in case of absence of managerial flexibility

The consideration of real options related to the investment project introduces asymmetries in the probability distribution of the NPV. This is because the opportunities to change the project are non-zero-sum games, which limit the distribution to the left (pessimistic scenario), but do not limit them on the right, since the same uncertainty related to the development of the project leaves the possibility that the project will also assume much larger proportions than those provided, open.

In other words, the presence of real options, given the management rights but not duties, extends the probability distribution to the right. It offers the opportunity to reap the benefits of the positive scenario evolution and at the same time to take action to contain the negative consequences of the unfavourable evolution of the variables that affect the value of the project.

The actual expected value of this asymmetric distribution exceeds the modal value of NPV in an amount equal to a premium that reflects the value of managerial flexibility, and Fig. 8.2 clearly proves it.

For the real options theory, the main elements that characterize the value of a project are the following:

- Initial investments related to the implementation of the project;
- Uncertain variables, of which the performance affects the decision related to the project;
- Gross value of the opportunity, characterized by the benefits resulting from the implementation of the option (it represents the final value of the project assuming the implementation of the option)
- Additional investment required to carry out the option;
- End of the option;
- Risk-free rate, corresponding to the yield of the bonds issued by the Treasury.

As a consequence of this, an investment opportunity must be carried out if the benefit arising from it is greater than the cost required. Since the value of the project is "optioned" i.e. subject to uncertainty, the evaluation of the cost effectiveness of the initiative is not amenable to the logic of the NPV.

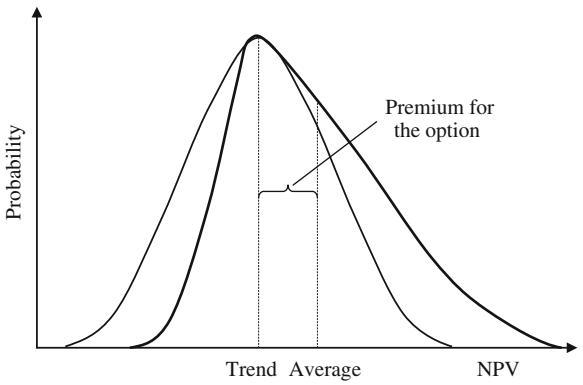


Fig. 8.2 The role of managerial flexibility in the probability distribution of the NPV

8.2 The Development of the Process

In the case of investment evaluation, a model represents all the logical and mathematical relationships among variables that characterize the project to be evaluated. The output of the model is in this case a number that summarizes the value of the project at the time of evaluation.

The process is instead the sequence of actions carried out by the investor from the moment he begins the analysis of an investment project to the obtainment of its final value. In this sense, the process also includes within itself the model that represents a crucial moment, but implies a dynamic and organic approach to the problem of resource allocation.

Therefore, adopting a perspective of the process, the evaluation of investments oriented to the enhancement of strategic opportunities could be structured along three main phases:

- Risk analysis;
- Strategic analysis;
- Quantitative analysis.

8.3 Risk Analysis

The main purpose of this phase is the identification and analysis of the uncertain variables, the evolution of which depends on the decisions related to the project. The moment of risk analysis aims to supply the quantitative information needed for the evaluation of the project.

The critical variables are generally represented by the evolution of the cash flows, the financial structure, the cost of construction, etc.

The determination of the variable, the evolution of which depends on the decision related to the implementation of the various opportunities, is a crucial

moment for the application of the real options approach. It is necessary to determine one or more stochastic variables from whose value derives the decision of how to proceed with implementation of the project.

Another question, of course, is the definition of the optioned project. In this case, starting on the performance of the stochastic variable, one needs to build a relationship that allows to estimate the activity subject to option.

This confirms the basic difference between a deterministic approach (NPV) and a stochastic (theory of Options) approach. In the first case, it is assumed that the behaviour of the reference variables is determinable in advance, or it is describable with a probability distribution. In the second case, it is assumed that the uncertain reference variables follow a stochastic behaviour,[2] represented by a mathematical model, which determines the estimation of the trends and volatility of these variables even through the identification of the relevant parameters.

Regarding the applicability of deterministic and stochastic approaches, it is useful to reiterate that the first assumes that on the market there is a twin activity (compared to the size of the risk) whose yield is directly adopted to discount the cash flows of the investment to be evaluated (otherwise it would not respect the principle of the opportunity cost of the resources employed). In the theory of options, the value of the investment (in its deterministic component) is given by the value of the right to capture the twin activity, which corresponds to the size that the project would have in the case of exercise of the options.

8.4 The Process of Strategic Analysis

The second key part of the process of strategic allocation of resources through the real options approach regards the identification of the areas of managerial flexibility implicit in the project to evaluate and to define the relationships between the different options. The definition of algorithms that define the conditions for the exercise of real options and the analysis of the logical sequence for the analysis of the identified options constitute the two outputs of this phase.

8.4.1 Identification of Areas of Managerial Adaptability

The first step consists of a series of evaluations made by the investor from the structure of the project and from the characteristics of the decision-making process. At this first stage of analysis it is important to involve all those who in different ways participate, even indirectly, to the process of taking strategic

[2] The movement of a variable whose value evolves in time in a condition of uncertainty is defined as a stochastic process.

decisions. Typically, these can be analysts, designers, the construction company and other professionals who have expertise and discretionary power in some of the areas of interest of the project.

8.4.2 Identification of Options and Their Parameters

The purpose of this phase is the identification real options and the formalization of the same through characteristic parameters, such as the value of the optioned project, the exercise price, expiration, and volatility.[3]

The recognition of a real option depends on the existence of two basic conditions:

- It must be a discretionary lever—available to the investor—that causes variations in the results of the project;
- It should lead to the identification of the parameters of the option.

On a conceptual level, the different types of real options—arising from any investment project—can be classified within the following taxonomy:

- Deferment options;
- Expansion options;
- Contraction options;
- Conversion options;
- Abandonment options;
- Temporary suspension options.

Specifically, looking in particular at real estate investments, the various options can be explained as follows[4]:

8.4.2.1 Deferment Options

The deferment option relates to the decision about the moment in which to start the project. This opportunity can arise, in general, from any situation in which it is

[3] "The investment projects incorporate real options, which are exercisable by the management at the most appropriate moment, these options have a value at the same time in which it recognizes a potential exercisability upon the occurrence of certain conditions, this value should be reflected in the overall evaluation of the project" (Micalizzi 1997).

[4] The study real options has been one of the most fruitful areas of research on the topic of real estate market. The approach to real options assumes that when an economic individual engages in an irreversible investment projects, he gives up the opportunity to postpone the start of the project at the time in which he has acquired new information that could affect the attractiveness of the investment. Not recognizing the value of leads to sub-optimal investment decisions (Yavas and Sirmans 2005).

believed that the implementation of a project can be delayed over time without undermining its technical feasibility. This opportunity has value if it is expected that something may happen within the period of deferment that increases the present net value of the project.

Typically there are therefore issues regarding the timing of the operation of an intervention of buildings, where the ownership of the building lot preserves intact the right to develop the transformation. The underlying asset (the optioned project) captured from the exercise of the option is given by the best expected value of the project in the case of positive scenario, that is, with a different point of view, from the cost savings associated with investing in case one decides not to proceed with the operation after finding an unfavourable scenario evolution.

When there is a possibility to defer the start of the investment, the investor has two options: to implement the project, having found a positive evolution scenario, giving up the initiative, saving the costs involved. This is typical of the real estate sector, regarding the decision to develop a project on an owned land, or the possibility of deferring waiting to check the stability of the prices and to see the uncertainty of the market resolved. The algorithm that represents the value of the option is:

$$Max(PV - In; 0)$$

where:

PV value of the expected benefit from the implementation of the project;

In Initial investment capitalized at time *n*, where n is the number of periods of deferment.

8.4.2.2 Expansion Options

This option allows to increase the share of the scale of a project a (with $a > 1$) making further investments *Ie*.

In the case of real estate investment, one may think to purchase additional units, for the expansion of the project, and so on.

After some time, a product added in a particular market may prove to be suitable to meet the needs of different markets or in different niches of the market itself. The importance of this option in a strategic optics is related to those initiatives in which the investor makes a series of initial investments that enable him to benefit particularly from the positive evolution of the scenario. The estimation can be done by applying an expansion parameter to the value of the existing project. As far as the exercise price is concerned, it coincides with the investment required to perform the expansion. This could involve the allocation of new facilities, improve the level of quality of the building, and so on.

Keep in mind that in the real estate field, a change in the size of the project, such as the amount built, may allow the developer to benefit from some economies

of scale. The choice to increase the scale of the project therefore facing additional production costs, in the construction field, generally produces an increase of costs that are less than proportional to the increase in cubage, at least up to a certain threshold of intervention.[5]

The algorithm that summarizes the condition of exercise typically takes the following form:

$$\text{Max } (PV;\ a \times PV\ -\ Ie)$$

where

PV	gross value of the project in the absence of strategic opportunities;
a	expansion factor (greater than 1) of the value of the project;
Ie	investment linked to the exercise of the option (exercise price).

It is hardly necessary to point out that instead of the gross value of the project, a function, that allows to place in the analysis the role of a particular uncertain variable, can be used (e.g., cash flow).

8.4.2.3 Contraction Options

This option detects, in this case, an opposite sign to the expansion option; it offers the possibility of reducing, by a c % percentage, the size of the initial project, saving an IC share of part of the initial investment. The decision on the sizing of a residential park can be taken considering the opportunity of reducing it to respond to unpredictable changes in the market. This of course, defining beforehand (a priori) the operating procedures of such an operation. The exercise price must be considered equal to the savings in operating costs or the possible achievable value of the contracted part of the program. The option of contraction has value in the event that the savings of further investments is higher than the worst expected value of the benefits resulting from the completion of the project.

It is assumed that the investor may divide the total investment in two parts:

$$I\ =\ Io\ +\ In$$

where Io is the immediately affordable investment and Io is the investment deferred to the future. This is the typical situation in which one has to choose the right mix between maintenance costs and construction costs. The formula that represents the value is:

---

[5] Please note that the morphological and volumetric aspects of a building are able to heavily influence the cost of construction. For example, if the height of the building increases, the ratio between useful floor area and gross floor area decreases because of the larger space required by technological systems, circulation spaces, stairwells and elevators, the presence of the latter, as well as foundations, is typically able to produce threshold effects (Bravi 2003).

$$(PV - In) + Max(Ic - (c \times PV); 0)$$

where:

In the part of the investment that can be postponed at time *n*;
Ic investment saved as a result of the decision of contraction;
C percentage of reduction of the original project.

8.4.2.4 Conversion Options

The conversion option regards the possibility of using the consequences of an investment project that has been prematurely interrupted (adaptability of the product) or rather, of changing, for example, the intended use of the property. Especially in the early stages of research and development, when the product is still fuzzy, it could highlight the possibility to redirect the efforts put on the development of a product which proves to be substantially different from the one initially aimed at achieving.

Alternatively, there may be the possibility to change the production process and the used factors (adaptable process), achieving the same output. This is to capture the best alternative use, choosing the maximum between the value of the project in its current use and the value in its best alternative use. The exercise price is the renunciation of the benefits arising from the project in its current use (or from the conversion costs).

The operating condition is thus formalized in the following equation:

$$Max\,(x \times PV - In;\, 0)$$

where

x	Value increase purchasable due to the conversion;
$x \times PV$	Value of the "optioned" project following the decision to proceed with the change of use;
In	The expected cost at time *n* for conversion.

8.4.2.5 Abandonment Option

Not different in terms of the logical aspect, is the case of the abandonment option, when one considers that in this case it also takes on an active attitude on behalf of the investor, who able to understand the elements of flexibility that the structure and characteristics of the project present. At the time of the preliminary evaluation of the operation, it is therefore necessary to recognize and possibly estimate the value represented by the opportunity that part of the efforts incurred up to the date of the potential exercise of the option, can be partially recovered, in the event of

abandonment of the original project. This option has value to the extent that the realizable value of the existing is higher than the worst-case scenario in case of continuation of the activity. An example is the case where the investment required for the project can be divided into lots, and the abandonment would result in the saving of costs related to subsequent lots which have not yet been realized (e.g., development of real estate in most units). The cost of each lot can be considered as the exercise price for acquiring the subsequent parts of the project.

The algorithm of the operating condition takes the following form:

$$Max\,(x \times PV - In;\ 0)$$

where

x	portion purchasable from the project;
$x \times PV$	value of the "optioned" project following the decision to proceed with the development;
In	the estimated cost at time n to continue the development of the project.

8.4.2.6 Temporary Suspension Option

This option, instead, is placed halfway between the abandonment option and the deferment options. It exists when it is technically possible, as well as convenient from an economic point of view, to stop the development of a project for a certain period, pending changes in market conditions. This is an opportunity for companies engaged in the construction of several residential complexes, which may temporarily suspend the activities of construction, or the business of marketing of real estate. This situation may allow a saving of some categories of variable costs, and has a value from the point of view of managerial adaptability if it is expected that within a certain range the variable operating costs are higher than the worst expected value of monetary income. In these circumstances, it may be better to bear the fixed costs and stop activity until the change of scenario reinstates the minimum condition of operating convenience.

The operating condition is the following:

$$(PV - Cf) - Min\,(Cv; F)$$

where:

F	annual revenues;
Cf	fixed costs per year;
Cv	variable operating costs.

If the annual revenues are less than the variable operating costs $Min\,(Cv;F) = F$, the decision maker has the convenience to suspend their activities, obtaining the value of the project, net of fixed costs.

In case of *Min (Cv;F) = Cv*, the investor prefers to work, supporting variable costs for the achievement of its revenues.

8.4.3 Verification of the Operating Conditions

In this phase, if more than one option comes out from the project it is necessary to define the order in which the different algorithms, that have been identified, should be applied. As a matter of fact, real options are often presented as compound options. In other words, if from a single project, different real options arise simultaneously, these must be combined within a unitary analysis scheme.[6] The problem of compound options, (i.e. an option made up from a plurality of options), requires special precautions in the evaluation stage (Example 8.1).

The final value certainly cannot be the algebraic sum of the values of the single options. The greater the number of existing options, the more likely it is that the incremental value of an additional option appears insignificant.

The degree of interaction between the options is a function of the type of action (*call or put*[7]) and of the distance between the operating times.[8]

The bond of interaction between compound options can be interpreted at two levels:

- With reference to a single project, there may be a temporal interaction, due to the dependence between current decisions and future development of the project itself (intra-project real option);

[6] The rule is that the first algorithm to be applied is the one for the real option, the exercise of which is less affected from the exercise of other real options.

[7] Financially speaking, a call option confers the right, but not the obligation, to its owner to purchase a stock at a stated price at a future time, conversely, a put option gives its owner the right to sell a stock at a set price at a future time.

[8] The sign of the interaction depends on the sequence in which they occur. The exercise of a first option can alter the structure of the underlying asset and therefore the value of subsequent options. The conditional probability of an option after the exercise of a previous one may be greater or less than the marginal probability of an exercise as a single option. If there are two real options of opposite sign (i.e. put or call), they are necessarily exercised in opposite situations. If, therefore, the exercise of the put option responds to the case of abandonment (i.e., the unfavorable evolution of the scenario), the exercise of the call may coincide with the development of the project (i.e. positive evolution of the scenario). In such situations, the conditional probability of exercising the second option, it being understood as the exercise of the first, it would be low and much less than the marginal probability of exercising the option when considered alone. If the two options were of the same type (two call or two put), the conditional probability of exercise of the second would be high, as well as the degree of interaction between the same. The degree of interaction depends on the distance of the periods of exercise for the two options considered. For two puts or two calls with exercise dates coincident and that do not interfere with each other, the combined value is approximately equal to the sum of the values considered individually (Trigeorgis 1996).

- Decisions taken in relation to a project, on the other hand, can generate effects on other projects: in this case one is dealing with the interaction of design (inter-project real option).

Sometimes the investment required for the completion of the initiative is not immediately supported. Rather, it is divided into shares at different times in the life of the project. This is the typical case of the development of real estate. In such circumstances, each instalment of the total investment can be seen as the afforded exercise price needed to acquire the subsequent options for continuation of the project. This is the case of the intra-project compound options.

The benefits that the investor can derive from a situation of this kind are clear. Each investment instalment, in fact, identifies a specific, strategic, decisional node in which the decision maker, facing the opportunity of evaluating alternative developments of the investment (abandonment of the project, conversion, temporary suspension), finds himself.

Temporal interaction contrasts with the case of inter-project options. This condition occurs whenever the implementation of an investment project becomes the prerequisite for the start-up of a second project.

Example 8.1[9] Table 8.1 shows the case of an investment related to the acquisition of a number of residential units that generates a cash flow of €30,000 (for the sake of simplicity, it is assumed that the investment runs out in a single period). Assuming that the investor has two different managerial levers, the first is the expansion of the project through an additional investment (Ie) which amounted to €14,000 for the improvement of the quality of housing, and the resulting increase of rental in an amount equal to an expansive factor of 1.4. The second is related to an investment, of implantation-type (Ic) for €11,000, which causes a decrease in the incidence of monetary costs on the flow, from 70 to 60 %.

The traditional analysis based on NPV, shown in Table 8.2, would draw a separate evaluation of the two opportunities. The first leads to an operating cash flow (Fc) equal to 28, and the second to an operating cash flow (Fc) equal to 29.

In neither case, therefore, does it seem appropriate to carry out additional investment, given that the base project ensures a flow of 30.

The two levers are considered as real options, with exercise prices *Ic* and *Ie* and values of the optioned project amounting to $(e \times Fb)$ and $(70\ \% - c) \times R_b$, where, e, equal to 40 %, represents the percentage of increase in cash flow, while c, equal to 60 %, represents the lowest level of the operating cost. The expansion leads to the following flow:

[9] The example is taken from Quigg (1995).

Table 8.1 Data relating to a real estate investment

Revenues (R_b)	€100,000	–
Operating costs (C_b)	€−70,000	[70 % of R_b]
Cash flow (F_b)	€30,000	–

Table 8.2 Cash flows of the optioned project

Expansion Option		
Expansion factor	1.4	[70 % of R_e]
Revenues (*Re*)	€140,000	
Operating costs (*Ce*)	€−98,000	
Initial investment (*Ie*)	€−14,000	
Cash Flow (*Fe*)	€28,000	
Option of cost reduction		
Incidence costs	60 %	[60 % of R_c]
Revenues (*Rc*)	€100.000	
Operating costs (*Cc*)	€−60.000	
Initial investment (*Ic*)	€−11.000	
Cash flow (*Fc*)	€29.000	

$$dF_e = F_b + Max\,(e \times F_b - Ie; 0) = 30{,}000 + Max\,(0.4 \cdot 30{,}000 - 14{,}000; 0)$$
$$= 30{,}000 + Max\,(-2{,}000; 0) = €30{,}000$$

The technology investment instead, leads to a cash flow equal to:

$$dF_c = F_b + Max\,[(70\,\% - c) \times R_b - Ic; 0] = 30{,}000 + Max(0.1 \times 100{,}000 - 11{,}000; 0)$$
$$= 30{,}000 + Max(-1{,}000; 0) = €30{,}000$$

So, by considering the investments separately, even in the form of options the same result as the previous one will be reached. If, on the other hand, one considers the interaction between them, or the possibility of proceeding with the investment related to the reduction of costs within the expansion investment, the value of the compound project can be expressed in the following way:

$$dF_b' = F_b + Max\,[e \times F_b - Ie + (70\,\% - c) \times (1 + e) \times R_b - Ic; 0]$$
$$= 30{,}000 + Max(0.4 \times 30{,}000 - 14{,}000 + 0.1 \times 1.4 \times 100{,}000 - 11{,}000; 0)$$
$$= 30{,}000 + Max(1{,}000; 0) = €31{,}000$$

It follows that the value of €1,000, given by $dF_b' - F_b$, is the result of the synergy existing between the two options considered together.

8.4.4 The Process of Quantitative Analysis

The purpose of this phase of the analysis is to reach the quantification of the value of strategic opportunities.

The quantitative analysis in turn consists of three steps. The first, is related to the calculation of the extended value of the project. Considered individually, the NPV summarises all the above considerations. In the second phase, the value of the interaction between the options, or the weight of strategic synergies that link together different real options, are considered. Lastly, the sensitivity analysis is developed in order to understand the impact of a change in volatility or a change in the expiry of the option.

8.4.5 The Calculation Models for Extended NPV

The real options approach includes a series of financial models intended to estimate the value of flexibility embedded in investment projects.

The main models are based on the notion of equivalent portfolios, which combine investments and debts so that the payoff of the option is replicated. Thus a hedging strategy which triggers the risk of neutrality and the consequent possibility of making the estimate in terms of the definite equivalent.

Mason and Merton (1985) assert that with the NPV, it is implicitly assumed that it is possible to identify market activity equal to the project under evaluation, i.e. having the same risk profile. The expected return on the twin activity is taken as the discount rate of the cash flows expected from the project. The evaluation of an option is developed on the same assumptions. Given the price of a twin activity to the project to be evaluated, the investor could build a properly balanced portfolio consisting of a number of units of the twin activity and an indebtedness that provides the same return on the project.

For the determination of extended NPV, it is possible to adopt evaluation models which directly approximate the stochastic process of the optioned project, in a continuous (Black and Scholes 1993)[10] or discreet manner.

In fact, non-financial investment and real estate in particular, normally assume a trend more similar to a discrete process than to a continuous one (Micalizzi 1995).

Among the discrete models for calculating the value of one of the most common options is the binomial (Cox et al. 1979; Cox and Rubinstein 1985). It is based on the assumption that the value of the optioned project evolves according to a stationary multiplicative binomial process. In a similar process, the S value of the project optioned at the beginning of a certain period can grow with probability q of

[10] The Black and Scholes formula can be used only in the case where the underlying asset includes only one option and the uncertainty is due to a single variable (Micalizzi and Renzetti 2000).

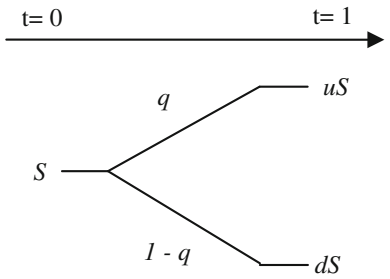


Fig. 8.3 Diagram of the binomial process

a multiplicative factor u (up), and may decrease with probability $1 - q$ of a reducing factor d (down) at the end of the period (Fig. 8.3).

The binomial method comes from the formulation of the value V of the extended project, assuming that the investor will replicate this value with the purchase of an asset at current value S_0 (or equivalently of an asset or portfolio of stocks perfectly correlated with S), borrowing an amount equal to D (debt) at the risk-free rate i.

The value of the replicating portfolio constructed in this way must equal the same revenues of the project V for every possible scenario. After a certain period the investor must repay the borrowed amount D and the related interest. Figure 8.4 shows the value of the portfolio.

By imposing the condition of equality between the flows of the two investment projects:

$$V^+ = nS_0^+ - (1+i)DV^- = nS_0^- - (1+i)D$$

It is possible to obtain the two parameters n and D:

$$n = \frac{(V^+ + V^-)}{(S_0^+ - S_0^-)} D = \frac{V^+ S_0^- + V^- S_0^+}{(S_0^+ - S_0^-)(1+i)}$$

From which recalling that $V = nS_0 - D$:

$$V = \frac{[pV^+ + (1+i)V^-]}{(1+i)} p = \frac{(1+i)S_0 - S_0^-}{S_0^+ - S_0^-}$$

where p represents the equivalent probability (or pseudo probability) that arises from the favourable scenario at zero risk conditions. This can be interpreted as the certainty equivalent to the expected cash flow that can be discounted at the risk-free rate *(risk-neutralized probability)*.

The today value of the option to invest tomorrow in the asset S is equal to the net expected value (risk-neutral) of the asset in the favourable situation discounted at the risk-free rate.

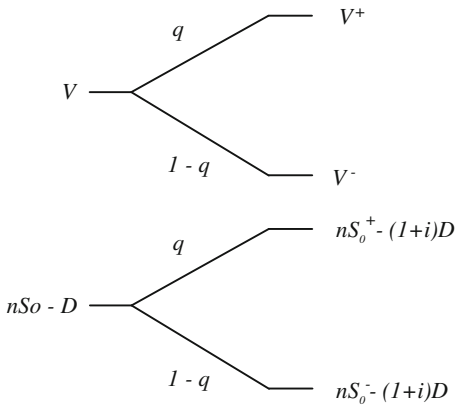


Fig. 8.4 Value of the optioned project in a binomial process

Example 8.2 An investor has the problem of evaluating the purchase of a land that is located in an area not yet explored from a real estate perspective. The decision must be taken quickly because the owner is negotiating with other counter-parties. There is a possibility that within a year the City Hall approves the urbanization plan that will lead to an overall development of the area.

The investor must assess, in a short time, the purchase of a property whose value might change shortly. There is the possibility to develop two different projects: the first involves the construction of 8 detached villas of 250 m^2, while the second involves the construction of 11 terraced houses of 120 m^2. At present, the reference price per square meter of a villa is estimated at €2,500 while the terraced house can be sold at €2,100. The sale price of a villa according to the first project would therefore amount to €625,000, while the price of a terraced house would amount to €260,000. The total costs of production are known and equal to €500,000 per villa and €160,000 per terraced house. The amount is estimated as constant for the next 2 years.

However, if the company defers the final decision to a year later, the approval of the plan of urbanization of the area could lead to changes in the project, in light of a change in the selling prices of properties. In particular, given the uncertainty that weighs on sales prices, it is believed that one year after the decision the prices of the two building types might evolve in the manner described in Fig. 8.5 with a probability of 50 % respectively.

At time 0, the project has the following cash flows:

$$CF = nP - C$$

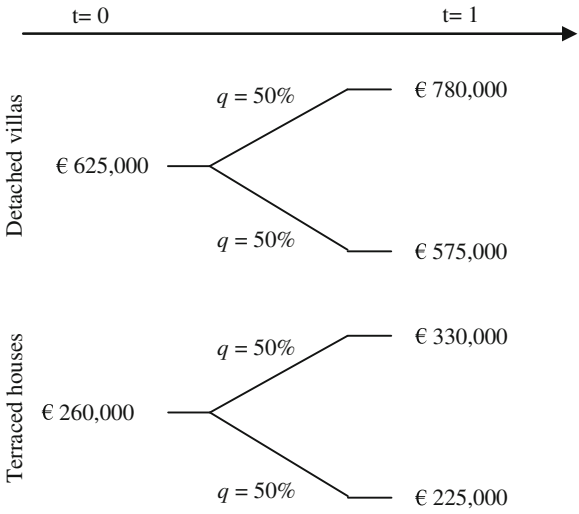


Fig. 8.5 Probable evolution of sales prices

where
n number of built real estate units;
P price of the units;
C total cost of production.

The flows corresponding to the two assumptions are:

- $CF_{villas} = 8 \times (625{,}000) - 8 \times (500{,}000) = 1{,}000{,}000$
- $CF_{houses} = 11 \times (260{,}000) - 11 \times (160{,}000) = 1{,}100{,}000$

Under present conditions, the most profitable project is that related to the construction of terraced houses. What would happen if the investor decides to defer the transformation for one year? (Table 8.3)

After a year he would opt for the project of detached villas in the event of a favourable evolution. Instead, he would choose to realize terraced houses if the scenario evolves unfavourably.

The problem is solved taking into account the value of the deferment. It is necessary to calculate the value at time 0 of a project that ensures at time 1 a flow of €2,280,000 in the case of favourable scenario and €660,000 in the unfavourable case scenario.

Considering a risk-free rate of 8 %, the risk-neutral probability of obtaining a flow of €2,280,000 is obtained as described in Table 8.4.

The extended value of the project is obtained by discounting at a risk-free rate values corresponding to the best use of the land in the two scenarios, one favourable and one unfavourable, weighing them with respect to risk neutral probabilities:

Table 8.3 Expected cash flows in the event of deferment

		Cash Flows
Detached villas		
Favourable scenario	8 × (780,000 − 500,000)	€2,280,000
Unfavourable scenario	8 × (575,000 − 500,000)	€600,000
Terraced houses		
Favourable scenario	11 × (330,000 − 160,000)	€1,870,000
Unfavourable scenario	11 × (220,000 − 160,000)	€660,000

$$V = \frac{[2{,}280{,}000 \times 0.48 + 660{,}000 \times (1 - 0.48)]}{1.08} = €1,331,111$$

The extended value of the land, in light of the possibility of deferring the choice between the two alternative uses, has a higher value than the best value of its current use. (€1.1 million).

It is hardly necessary to point out that if DCF had been used, the conclusions would have been distorted. If current market prices reflect expectations and are therefore equal to the present value of the expected cash flows, the rates implied in the prices of the market would be the following (k) in Table 8.5.

By applying the two rates obtained for the values corresponding to the best use of the land, it would lead to different current values (Tables 8.6, 8.7).

In order to be able to set up the analysis of the multi-period cash flows, taking into account the real options, a slightly more complex approach than the one described above should be taken. According to the model of Cox, Ross and Rubinstein (CRR), the prices follow a time pattern that simulates a binomial multiplicative process of the type in Fig. 8.6.

The binomial paradigm develops the modifications of the initial value of the investment through probabilistic multiplicative states, as defined by the coefficients $u > 1$ and $d < 1$ which represent, respectively, the evolution of the initial state to a favourable scenario or to an unfavourable scenario.

The measurement of the coefficients u and d is the result of the risk analysis of the investment, statistically calculated through a dispersion index that, in the case of normal distribution of the variable object of the analysis, coincides with its standard deviation (σ).

Once the risk has been estimated, the definition of the possible states of evolution occurs with mathematical expressions:

Table 8.4 Calculation of risk-neutral probability

Detached villas	$p = \frac{(1.08 \times 625{,}000 - 575{,}000)}{(780{,}000 - 575{,}000)} = 0.48$
Terraced houses	$p = \frac{(1.08 \times 260{,}000 - 220{,}000)}{(330{,}000 - 220{,}000)} = 0.55$

Table 8.5 Calculation of the rates implied in market prices

Detached villas	$\frac{[780{,}000 \times 0.50 + 575{,}000 \times 0.5]}{1+\mathrm{k}} = 625{,}000$	k = 8.40 %
Terraced houses	$\frac{[330{,}000 \times 0.50 + 220{,}000 \times 0.50]}{1+\mathrm{k}} = 260{,}000$	k = 5.77 %

Table 8.6 Calculating the value corresponding to the best use (k = 8.40 %)

Detached villas	$V = \frac{[2{,}280{,}000 \times 0.50 + 600{,}000 \times 0.50]}{1.084} = 1,328,413$
Terraced houses	$\mathrm{V} = \frac{[1{,}870{,}000 \times 0.50 + 660{,}000 \times 0.50]}{1.0577} = 1{,}195{,}991$

Table 8.7 Calculating the value corresponding to the best use (k = 5.77 %)

Detached villas	$V = \frac{[2{,}280{,}000 \times 0.48 + 600{,}000 \times (1 - 0.48)]}{1.08} = 1{,}302{,}222$
Terraced houses	$V = \frac{[1{,}870{,}000 \times 0.55 + 660{,}000 \times (1 - 0.55)]}{1.08} = 1{,}227{,}315$

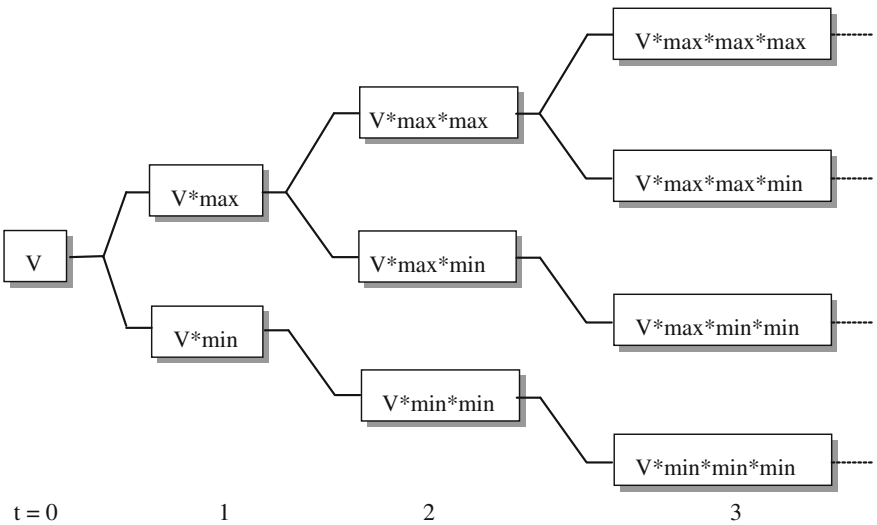


Fig. 8.6 Diagram of the multiplicative binomial process

$$\begin{cases} u = e^{\sigma\sqrt{dt}} \\ d = e^{-\sigma\sqrt{dt}} \end{cases}$$

where:
e Napier's number;
σ standard deviation, also called volatility;
dt time interval between successive evolutions of scenario.

With the use of the coefficients u and d the initial value of the investment is a typical tree structure (tree of scenarios), derived from the decision tree analysis. Following the risk analysis, there is the construction of the decision tree. Feasible options are identified and the corresponding values are quantified at this stage. The decision tree is used to measure the impact produced, based upon on financial analysis, by the possible options for the development of the investment. The measurement of the impact requires the preliminary definition of a maximizing function, conformed to the particular type of the identified option. With this function, the year in which the option is exercised and for every possible scenario that year, the comparison of the present value of the investment "with" and "without" the option[11] is carried out.

The operation described above, performed for all the n scenarios of the year in which the option is feasible, allows to determine a vector of the majors, of size $n \times 1$, which is then discounted following the tree of scenarios from right to left. The calculation is done by weighting the elements of the vector with the neutral risk probability coefficients (p and $1 - p$) and by bringing current events back to the results of the weights through a discount rate (r_i). The p and $1 - p$ probabilities, called risk neutral probabilities are calculated through the following expression:

$$p = \frac{(1 + r_i) - d}{(u - d)}$$

$$1 - p = 1 - \frac{(1 + r_i) - d}{(u - d)}$$

The two coefficients to be used for the weighting of the values of the various scenarios are such that, if it were not convenient to exercise any option in the scenarios of the analysis period, the initial value of the investment would be returned to year zero.

The result represents the present value of the investment, a value that includes the effect of the option or of the options that may be exercised.

[11] The model is used by Manganelli et al. (2014b).

References

Black, F., & Scholes, M. (1993). The pricing of options and corporate liabilities. *Journal of Political Economy, 3*, 637–654.

Bravi, M. (2003). Incertezza nella valutazione degli investimenti immobiliari: la teoria delle opzioni reali (real option theory). *Aestimum, Atti del XXXII Incontro Ceset*, 373–393.

Cox, C., & Rubinstein, M. (1985). *Option market*. New Jersey: Prentice Hall.

Cox, C., Ross, S., & Rubinstein, M. (1979). Option pricing: a simplified approach market. *Journal of Financial Economic, 7*, 384–463.

Dixit, A. K., & Pindyck, R. S. (1994). *Investment under uncertainty*. Princeton, NJ: Princeton University Press.

Manganelli, B., Morano, P., & Tajani, F. (2014). Risk assessment in estimating the capitalization rate. *WSEAS Transactions on Business and Economics, 11*, 199–208.

Mason, S. P., & Merton, R. C. (1985). The role of contingent claim analysis in corporate finance. In E. I. Altman & M. G. Subrahmanyam (Eds.), *Recent advances in corporate finance*. Illinois: Homewood.

Micalizzi, A. (1995). Opzioni reali e nuovi strumenti di trattamento del rischio in relazione ad investimenti complessi (chapter 8). In M. Dallocchio (Ed.), *Finanza d'azienda—Analisi e valutazioni per le decisioni d'impresa*. EGEA: Milano.

Micalizzi, A. (1997). *Opzioni reali: Logiche e casi di valutazione degli investimenti in contesti di incertezza*. Milano: EGEA.

Micalizzi, A., & Renzetti, M. (2000). La valutazione delle imprese Internet mediante la real option valuation. In F. Perrini (Ed.), *E-valuation* (p. 242). Milano: McGraw Hill.

Quigg, L. (1995). Optimal land development. In L. Trigeorgis (Ed.), *Real options in capital investments, models, strategies and applications*. Preager: Connecticut.

Trigeorgis, L. (1996). *Real options: Managerial flexibility and strategy in resource allocation*. Cambridge: MIT Press. Mass.

Yavas, A., & Sirmans, C. F. (2005). Real Options: Experimental Evidence. *The Journal of Real Estate Finance and Economics, 31*, 27–52.