AESTIMUM
CENTRO STUDI DI ESTIMO E DI ECONOMIA TERRITORIALE - Ce.S.E.T.

Firenze University Press
www.fupress.com/ceset

Special Issue "Visions of the future in real estate appraisal"

Cyclical capitalization: basic models

Maurizio d'Amato[1], Giuseppe Cucuzza[2,*]

[1] *Department of Civil, Environmental, Land, Construction and Chemistry (DICATECh), Polytechnic University of Bari, Italy*
[2] *Department of Agriculture, Food and Environment (Di3A), University of Catania, Italy*
E-mail: maurizio.damato@poliba.it, giuseppe.cucuzza@unict.it
*Corresponding author

Citation: d'Amato, M., & Cucuzza, G. (2022) Cyclical capitalization: basic models. *Aestimum* 80: 45-54. doi: 10.36253/aestim-12625

Received: January 18, 2022

Accepted: June 20, 2022

Published: October 17, 2022

Data Availability Statement: All relevant data are within the paper and its Supporting Information files.

Competing Interests: The Author(s) declare(s) no conflict of interest.

ORCID:
MDA: 0000-0002-6719-9056
GC: 0000-0002-4627-300X

Abstract. The relevance of market cycles is known in the financial markets and in the context of real estate valuations it manifests itself in the estimate of the "exit value" of the Discounted Cash Flow Analysis. The hypothesis that the market cycle has a behaviour very similar to what happened in the past introduces some risks and uncertainty in the estimated value. To allow a more extensive use of cyclical capitalization in formulating value judgments, this paper proposes two methodological adaptations to the original model: the first, based on the presence of a regular market trend; the second based on the hypothesis of irregular market cycles and therefore more representative of the dynamics to which a specific real estate segment is exposed. In the perspective of a more extensive availability of information, data and extra-data, other application areas are also identified on which further investigations need to be developed.

Keywords: Cyclical capitalization, Dividend Discount Model, g-factor, Real estate valuation, DCFA.
JEL codes: C19, E32, E43, R39.

1. INTRODUCTION[1]

Gordon e Shapiro (1956) developed the well-known model *Dividend Discount* (DD) to estimate the present value of a firm distributing growing dividends at a percentage *g*, defined growth factor. The term growth factor or g-factor can be considered imprecise because it may be either positive or negative (Smith et al., 1998). In general term the model is the following:

$$V = \frac{D}{Y-g} \tag{1}$$

where
V_{DD} = firm value

[1] This paper is based on the presentation provided by one of the authors during an event in honor of prof. Marco Simonotti in Catania his hometown organized by Geo.Val. It is the first article on an Italian review dedicated to this brand new income approach models. The work was carried out in close cooperation between the two authors. The merit of the publication must be equally divided among them.

D = Dividend distributed
Y = Discount rate
g = growth or degrowth factor

The model was developed for the valuation of firm able to distribute dividend, subsequently the model was applied to property valuations. Since the 50s of the last century, the growth of the inflation rate and the growth of the price and rent in real terms determined the application of these models to the property market (French, 2019). Traditionally in real estate market is used the ratio between rent and overall capitalization rate or yield rate based on market comparables as in the Equation 2 below (where *NOI* is Net Operating Income):

$$V = \frac{NOI}{R_0} = \frac{R}{y} \tag{2}$$

Such method is normally applied in the valuation of market value whilst the Dividend Discount Model (DDM) is applied for the valuation of investment value and the determination of scrap value in the Discounted Cash Flow Analysis (DCFA).

In the application of the DDM to income producing properties the term *D* in the Equation 1 is replaced by Net Rent or *Net Operate Income*, whilst the *g-factor* is calculated, according to US standards, as the product between the sinking fund factor per the future variation in term of capital and rent for the remaining life of the property. According to Commonwealth Standards the g-factor is calculated subtracting from the expected rate of rental growth the expected depreciation calculated in different ways (Baum and Crosby, 1998).

A first method is the extrapolation of the g-factor using time series of rental values reflecting both long term trends and cyclical variations, a further approach is using economic variables that may affect property yields like interest rates and finally a combination of approaches may be a combination of both approaches. The depreciation rate can be calculated in several different ways. The former is the so-called empirical approach through a comparison between the current rental value of a new building with the one to be estimated. An annualized difference become a measure of depreciation. Another method is the so-called theoretical approach (Baum,1991) deducting the land value and calculating the depreciation of building cost over the building life. In this model the cyclicality of the property market is not included in the model but in the g-factor determination. In Italian Standard for appraiser of Italian Association of Bankers (ABI, 2022) a general indication is provided in the "yield and change formulas" method deriving the overall capitalization rate as a difference between the discount rate or yield rate and a D which can be considered a way to include the g-factor as a part of Italian Standards. In general term it can be considered as the variation in term of property price and rent of the property along the time. In US Standards there are several methodologies to estimate the g-factor. One of the most important is the so-called Inwood Premise. In this case the g-factor is estimated as a product between the growth rate calculated in the market segment multiplied by a sinking fund factor (Italian "quota di reintegrazione") at the risk-free rate referred to the economic life of the property. Early applications of this model (d'Amato, 2013; d'Amato,2015; d'Amato 2017a; d'Amato, 2017b; d'Amato, 2018; d'Amato et al., 2019) referred to the US standards in order to test the valuation accuracy compared to the traditional direct capitalization techniques. In the early applications the meaning of the Inwood Premise was changed. The g-factor become a product between the variation in term of rent a price in a specific market phase instead of being the variation along the building life. Therefore, different property market phases depict different g-factors and, as a consequence the overall cap rate became a dynamic concept instead of a static one.

Therefore, discount rate is the target rate of return, whilst the difference between the target rate of return and the growth rate will be the capitalization rate or all-risk yield, which will be calculated also to determine the exit value in the DCFA.

Several papers highlighted limits of the application of DDM showing a meaningless valuation accuracy with an important difference between the value and price (Jacobs and Levy, 1988). In some cases, this difference is approximated to 88% and it is 4,21 times compared to the results obtained applying the Price Earnings ratio (Hickman and Petry, 1990).

Although the problems have been raised in the financial applications, critical remarks may be also referred to the applications in real estate valuations. Imprecise determination of g-factor may have an impact on the final result (Gehr, 1992).

This paper proposes a variation of the original Dividend Discount Model applied to property valuation. In particular, a g-factor determination is realized, based on the evolution of property market cycle in the specific real estate market segment (Roulac, 1996).

After the Global Financial Crisis, the relevance of the role of property market cycle in the valuation process has been increasing. The role of property market cycle has been stressed and an extensive literature review is provided in a seminal work (Born and Pyhrr, 1994). In particular, Roulac stressed in a visionary contribution that "*…the concept of market cycles dominates the concerns of, and is employed as a rationalization by, real estate investment professionals. Perceptions of real estate cycles influence market participants' strategies and transactions decisions…*" (Roulac, 1996, p.2). Subsequently, the analysis of the trend of the real estate market cycles, led to the identification of some valuation models called "Cyclical Dividend Discount Models" (d'Amato, 2001), which allow evaluate a property whose Net Operate Income increases or decreases cyclically.

Recently, has been proposed an initial classification of cyclical capitalization models in four different groups (d'Amato, 2018). In these groups have been included not only the direct capitalization based on the Dividend Discount Model but also a model based on the traditional form of direct capitalization. One of the groups is dedicated to the application of cyclical capitalization to limited in time rent.

The paper is organized as follows: in the first part is provided a brief introduction on property market cycle and the first version of cyclical capitalization (d'Amato, 2001). In the following paragraph after presenting a second version of the model (d'Amato, 2003) will be exposed the results of several applications of the model. Final remarks and future directions of research will be offered at the end.

2. PROPERTY VALUATION AND MARKET CYCLE: THE FIRST MODEL (2001)

The relevance of property market cycle has been stressed even in the Holy Bible (Chapter 41 of Genesis). In this chapter is described a Pharaoh's dream with seven fat cows and seven lean cows. Prophet Joseph was able to interpret this dream with a cyclical alternate of expansive and recessive property market cycles. Kuznets pioneer work highlighted property market cycle with an amplitude of 15-25 years strongly correlated with immigration, growth of building activity (Kuznets, 1930) among the others. Hoyt (1933), analyzing the value of the land in Chicago between 1830 and 1933 described different cycles relate to population growth, rent level, management cost of building and land prices. Bjorklund and Pritchett (1984) proposed the vacancy rate between price and rent as an appropriate indicator for property market cycle.

Peiser (1983), studying the relationship between inflation and discount rate, proposed a causal relationship between the decreasing of overall capitalization growing expectation on inflation rate. Hekman (1985) demonstrated the cyclicality of building sector in an analysis of the property market trend in the office market of 14 cities in the period between 1979 and 1983. Witten (1987) explored the relationship between economic cycle and property acquisition, whilst Voith e Crone (1988) discovered a strong relationship between vacancy in the office market and property market cycle in 17 great metropolitan areas in the United States in the years 1980-1987

In a seminal article, Pyhrr, Webb and Born (1990) proposed a Discounted Cash Flow model to measure the relationship between the economic variables and the performance of property. In this paper a relationship between a cyclical variable like inflation rate and real estate return has been highlighted. In another successive contribution Born and Pyhrr (1994) introduced in the valuation model the cycles of demand and supply of property in a specific market segment, the life cycle of the building and the economic cycle of urban area. In this paper they included in the model an analysis on their impact on the valuation procedure, debt structure and real estate investment diversification. Clapp (1993) showed the correlation among economic variables like labor, demand and supply and absorption and vacancy rate in real estate market segment of office, using a case study. Afterwards, Mueller e Laposa (1996) explored the rent distribution in different property market cycle. Hendershott (1996) observed that the value of real estate properties, in the expansive phases of the market cycle, tends to be overestimated by investors, whilst during the recessive phases, it is underestimated. Other analyses (Clayton, 1996) concerned the property market cycle of residential properties during the period 1982-1994 in Vancouver, through a historical series conducted on eight different market segments. DeLisle and Grissom highlighted the procyclical nature of the traditional direct capitalization (DeLisle and Grissom,2011). An application of HP Hodrick-Prescott filter to build Real Estate Cycle Indicator (RECI) (Witckiewicz, 2002). A taxonomy of property market cycle is proposed by Phyrr et al. (2003). In their seminal work (Malpezzi and Wachter, 2005) presented a model of lagged supply response to the price change and speculation may be able to generate real estate market cycles. The relevance of housing price and transactions as indicators for real estate market cycles has been proposed (Festa et al., 2012). The importance of bubble the economy is indicated in literature (Grover and Grover, 2014) together with the delicate role of the bubble in the market segment of commercial property because of the inelasticity of supply. The use of Markov Chain to provide forecast for portfolio's future risk across cycle was developed by Evans and Mueller (2016). A rigorous analysis on real estate research is provided by (Kampf Dern et al., 2018).

As for the formulation of the cyclical capitalization model, it should be remembered that in the valuation of an investment, the capitalization rate used is determined by combining the Fisher Approximation Equation with the Gordon formula (Baum and Crosby, 1998). Therefore, the capitalization rate can be defined as the sum of the following components:

$$r = RFR + RP - g \qquad (3)$$

where:
r = overall cap rate/yield rate
RFR = risk free rate
RP = risk premium rate
g = g-factor

However, real estate tends to lose value over time because of physical deterioration and functional obsolescences. The determination of the previous capitalization rate, therefore, should be reformulated taking into account an incremental term that allows to include obsolescence and deterioration in the determination of all risk yield (Baum, 1988). Therefore:

$$r = RFR + RP - g + d \qquad (4)$$

where, d is the expected depreciation caused by both physical deterioration and functional obsolescence. The relationship between the real estate value and the microeconomic variables can therefore be defined strong. Cyclical capitalization fundamental models presented focus the attention on the relationship between the g-factor and the real estate market cycle, assuming the other terms of the relationship are constant. Market cycles, in turn, have numerous classifications and among the most commonly used is the one that divides the cycle into two main phases: "expansion-contraction" and "recovery-recession" (Mueller and Laposa, 1994). Assuming that the discount rate is constant and that the cyclical phases of the real estate market have the same duration, in the first version of the proposed cyclical capitalization, the distinction with the Gordon-Shapiro model (1956) can be represented as schematized in Figure 1.

In fact, whilst in the first case more than one g-factor is determined, distinguishing a property market phase of growth from a phase of contraction both in terms of income and capital gain, in the second case, it is possible to observe an ever-growing value over the time.

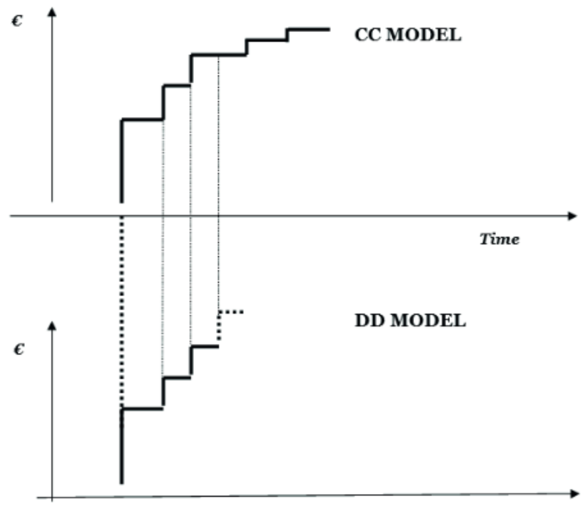

Figure 1. The relationship between value and time in the DD model and in the CC model assuming the constant discount rate.

A cycle may have two phases, the former of expansion-contraction, with negative g-factors, the latter of recovery-recession with positive g-factors, therefore it is necessary to distinguish two different g-factors or different capitalitazion rate/yield rate. Opinion of value will be equivalent to the sum of the different "intervals" elaborated using different g-factors. The sum of different slices of value.

Consequently, valuation of the property is characterized by a defined market cycle based on the hypothesis that future cycle has a behaviour similar to what happened in the past. Valuer, according to the time of the valuation may start predictably with a Recovery-Recession phase or with an Expansion-Contraction phase having a duration equal to t. It depends on the data available and the characteristics of time series observed by the valuer. The time series may refer to a specific interval of time that has been defined "backward holding period" of 10-15 years in which it is possible to observe the temporal lag of each property market phase and the rate of variation in term of property price and property rent. The value of the property in each property market phase will be calculated through the difference between the value of the property at the beginning of the Recovery-Recession phase (moment 0), and the value of the property at the end of the Recovery-Recession phase, discounted at time 0. Therefore, each interval will be summed up reaching the opinion of value as in the Equation 5 below:

$$V = \frac{NOI}{R} - \frac{NOI}{R(1+Y)^t} \qquad (5)$$

Using Dividend Discount Model the expression is:

$$V_{RR} = \frac{NOI}{Y + g_{RR}} - \frac{NOI}{Y + g_{RR}} \frac{1}{(1+Y)^{trr}} \quad (6)$$

The value in the first cycle (composed by one phase of recovery recession) will be summed up to the second property market phase (expansion-contraction) as in the Equation 7 below:

$$V_{1stPhaseRR+2ndphaseEC} = \frac{NOI}{Y + g_{RR}} - \frac{NOI}{Y + g_{RR}} \frac{1}{(1+Y)^{trr}} + \frac{NOI}{Y - g_{EC}} \frac{1}{(1+Y)^{tec+trr}} + - \frac{NOI}{Y - g_{EC}} \frac{1}{(1+Y)^{tec+2trr}} \quad (7)$$

Considering a number *n* of phases and assuming $t_{rr} = t_{ec} = n$, then, we have:

$$V_{CC} = \frac{NOI}{Y + g_{RR}} - \frac{NOI}{Y + g_{RR}} \frac{1}{(1+Y)^{n}} + \frac{NOI}{Y - g_{EC}} \frac{1}{(1+Y)^{n}} - \frac{NOI}{Y - g_{EC}} \frac{1}{(1+Y)^{2n}} + + \frac{NOI}{Y + g_{RR}} \frac{1}{(1+Y)^{2n}} - \frac{NOI}{Y + g_{RR}} \frac{1}{(1+Y)^{3n}} \ldots \quad (8)$$

The model assumes that the cycle is substantially repeated in an identical and continuous manner. The valuer's forecast shifts from a single capitalization rate representative of all future fluctuations, to two or a plurality of which represent the cyclicality of the market. The assumption that the phases of the cycle have the same duration may be considered strong. Normally, market cycles may have irregular phases, with an expansion phase that can be shorter than the recession phase, or vice versa. Anyway, starting from Equation 8 it is possible to write:

$$V_{CC} = \frac{NOI}{Y + g_{RR}} \left[1 - \frac{1}{(1+Y)^{n}} + \frac{1}{(1+Y)^{2n}} - \frac{1}{(1+Y)^{3n}} + \ldots \right] + + \frac{NOI}{Y - g_{EC}} \left[\frac{1}{(1+Y)^{n}} - \frac{1}{(1+Y)^{2n}} + \frac{1}{(1+Y)^{3n}} - \frac{1}{(1+Y)^{4n}} + \ldots \right] \quad (9)$$

Therefore:

$$V_{CC} = \frac{NOI}{Y + g_{RR}} \left(1 - \frac{1}{(1+Y)^{n}} + \frac{1}{(1+Y)^{2n}} - \frac{1}{(1+Y)^{3n}} + \ldots \right) + + \frac{NOI}{Y - g_{EC}} \frac{1}{(1+Y)^{n}} \left(1 - \frac{1}{(1+Y)^{n}} + \frac{1}{(1+Y)^{2n}} - \frac{1}{(1+Y)^{3n}} \ldots \right) \quad (10)$$

Finally:

$$V_{CDD'} = \left[\frac{NOI}{Y + g_{RR}} + \frac{NOI}{Y - g_{EC}} \frac{1}{(1+Y)^{n}} \right] \left(1 - \frac{1}{(1+Y)^{n}} + \frac{1}{(1+Y)^{2n}} - \frac{1}{(1+Y)^{3n}} \ldots \right) \quad (11)$$

The second part of the Equation 11 represents an infinite geometric progression. When the common ratio for an infinite geometric progression is included in the following interval -1 <r <1, the progression will tend to the following Equation 12:

$$\sum_{i=1}^{\infty} r_i = \frac{1}{1 - r} \quad (12)$$

where $r = -\frac{1}{(1+Y)^{n}}$

Consequently, it follows that the value of perpetuity can be calculated as in the following Equation 13:

$$V_{CDD'} = \frac{1}{1 + \frac{1}{(1+Y)^{n}}} \left[\frac{NOI}{Y + g_{RR}} + \frac{NOI}{Y - g_{EC}} \frac{1}{(1+Y)^{n}} \right] \quad (13)$$

And finally:

$$V_{CDD'} = \frac{(1+Y)^{n}}{(1+Y)^{n} + 1} \left[\frac{NOI}{Y + g_{RR}} + \frac{NOI}{Y - g_{EC}} \frac{1}{(1+Y)^{n}} \right] \quad (14)$$

In this formulation, the cyclical capitalization model is based on two different g-factors, but it can also be applied with reference to two different capitalization rates. From Equation 12 it is easily possible to go back to the original model of Gordon-Shapiro (1956) as a particular case of the cyclical capitalization model. In fact, in the presence of the same cap rate or yield rate, it is possible to write:

$$V_{CC} = \frac{(1+Y)^{n}}{(1+Y)^{n} + 1} \left[\frac{NOI}{Y - g} + \frac{NOI}{Y - g} \frac{1}{(1+Y)^{n}} \right] \quad (15)$$

And therefore:

$$V_{CC} = \frac{NOI}{Y - g} \frac{\cancel{(1+Y)^{n}}}{\cancel{(1+Y)^{n} + 1}} \left[\frac{\cancel{(1+Y)^{n} + 1}}{\cancel{(1+Y)^{n}}} \right] = \frac{NOI}{Y - g} \quad (16)$$

The application of the model can be carried out by determining the g-factors through an econometric analysis of time series (d'Amato, 2015) or it can be developed using the variation ratio on the observed time series (d'Amato, 2022). Capitalization rates can be calculated, respectively, one on the basis of the comparables available at the time of the valuation (commonly known as "support") and the other one on the basis of forecasts formulated by of the valuer or a company specialized on market analysis. It is clear therefore the role of the valuer and the property market cycle in the process of property valuation. The first version of the proposed model is conditioned by the hypothesis that the cyclical phases of the market have the same temporal length.

3. SECOND VERSION OF THE MODEL (2003)

The second version of the cyclical capitalization model therefore aims to seek a methodology that interprets market cycles that have variable duration, in relation to the context of real estate valuations as outlined in Figure 2.

This model is also applicable in this condition by dividing the market cycle into a series of intervals of time having a temporal length equivalent to the shorter one between the two phases of "Recovery-Recession" and "Expansion-Contraction". The entire cycle is therefore divided on the basis of the duration of the smaller phase, as illustrated below:

$$V_{CDD^*} = \left[\begin{aligned} &\left(\frac{NOI}{Y+g_{RR1}} - \frac{NOI}{Y+g_{RR1}} \frac{1}{(1+Y)^t} \right) + \left(\frac{NOI}{Y+g_{RR2}} \frac{1}{(1+Y)^t} - \frac{NOI}{Y+g_{RR2}} \frac{1}{(1+Y)^{2t}} \right) + \\ &+ \left(\frac{NOI}{Y-g_{EC1}} \frac{1}{(1+Y)^{2t}} - \frac{NOI}{Y-g_{EC1}} \frac{1}{(1+Y)^{3t}} \right) + \left(\frac{NOI}{Y-g_{EC2}} \frac{1}{(1+Y)^{3t}} - \frac{NOI}{Y-g_{EC2}} \frac{1}{(1+Y)^{4t}} \right) \end{aligned} \right] \quad (17)$$

The entire cycle can then be plotted by a number of g-factors - with n> 2 (otherwise we have the first model 2001) - whose temporal length is the duration of the shortest cycle phase. Assuming a cycle that can be described by four g-factors, we have:

$$V_{CC} = \left(1 - \frac{1}{(1+Y)^t}\right) \left[\frac{NOI}{Y+g_{RR1}} + \frac{NOI}{Y+g_{RR2}} \frac{1}{(1+Y)^t} + \frac{NOI}{Y-g_{EC1}} \frac{1}{(1+Y)^{2t}} + \frac{NOI}{Y-g_{EC2}} \frac{1}{(1+Y)^{3t}} \right] \quad (18)$$

Assuming that the cycle occurs with the same regularity over time:

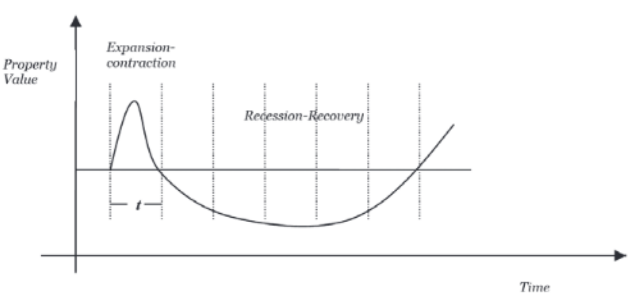

Figure 2. Second Version Cyclical Capitalization Models.

$$V_{CC} = \left(1 - \frac{1}{(1+Y)^t}\right) \left[\begin{aligned} &\frac{NOI}{Y+g_{RR1}} + \frac{NOI}{Y+g_{RR2}} \frac{1}{(1+Y)^t} + \\ &+ \frac{NOI}{Y-g_{EC1}} \frac{1}{(1+Y)^{2t}} + \frac{NOI}{Y-g_{EC2}} \frac{1}{(1+Y)^{3t}} \end{aligned} \right] \left(1 + \frac{1}{(1+Y)^{4t}} + \frac{1}{(1+Y)^{8t}} \ldots \right) \quad (19)$$

where $4t$ represents the duration of the cycle consisting of 4 time intervals of equal length. Similarly, to what was previously highlighted, also in the new formulation of the model it is possible to observe that the third part of the formula represents a geometric progression with the following ratio included in the interval -1< r <1.

$$r = \frac{1}{(1+Y)^{4t}} \quad (20)$$

Therefore

$$V_{CDD^*} = \left(1 - \frac{1}{(1+Y)^t}\right) \left(\frac{(1+Y)^{4t}}{(1+Y)^{4t} - 1} \right) \left(\begin{aligned} &\frac{NOI}{Y+g_{RR_1}} + \frac{NOI}{Y+g_{RR_2}} \frac{1}{(1+Y)^t} + \frac{NOI}{Y-g_{EC_1}} \frac{1}{(1+Y)^{2t}} + \\ &+ \frac{NOI}{Y-g_{EC_2}} \frac{1}{(1+Y)^{3t}} \end{aligned} \right) \quad (21)$$

Then,

$$V_{CC} = \left(\frac{(1+Y)^{3t}}{((1+Y)^{2t}+1)((1+Y)^t+1)} \right) \left(\begin{aligned} &\frac{NOI}{Y+g_{RR_1}} + \frac{NOI}{Y+g_{RR_2}} \frac{1}{(1+Y)^t} + \frac{NOI}{Y-g_{EC_1}} \frac{1}{(1+Y)^{2t}} + \\ &+ \frac{NOI}{Y-g_{EC_2}} \frac{1}{(1+Y)^{3t}} \end{aligned} \right) \quad (22)$$

Finally,

$$V_{CC} = \frac{NOI}{(1+Y)^{3t} + (1+Y)^{2t} + (1+Y)^t + 1} \left(\frac{(1+Y)^{3t}}{Y+g_{RR_1}} + \frac{(1+Y)^{2t}}{Y+g_{RR_2}} + \frac{(1+Y)^t}{Y-g_{EC_1}} + \frac{1}{Y-g_{EC_2}} \right) \quad (23)$$

There may also be two g-factors for the Expansion-Contraction phase and a single g-factor for the Recovery-Recession phase, in the event that the latter is the shortest phase of the cycle. This kind of forecast allows for the definition of a more flexible cyclical capitalization model in methodological terms and represents a further method of "reading" the market cycle relating to the market segment of the property to be appraised. In general terms, the two models can be summarized in the following Table 1.

Both cyclical capitalization models present some differences compared to the traditional direct capitalization model with explicit growth, as described in Tab. 2 in terms of assumptions and inputs

Consequently, it is possible to calculate two different capitalization rates which also take into account the cyclical trend of the market segment to which the US refers and the relative real estate value thus determined. Using Dividend Discount Model, the capitalization rate can be obtained as follows:

Table 1. Two early version of Cyclical Capitalization.

Cyclical Capitalization First Model (2001)	
$V=\frac{(1+Y)^n}{(1+Y)^n+1}\left[\frac{NOI}{Y+g_{RR}}+\frac{NOI}{Y-g_{EC}}\frac{1}{(1+Y)^n}\right]$	Regular Cycle no more than two different all risk yield rate – cap rate per each phase
Cyclical Capitalization Second Model (2003)	
$V_{CDD''}=\frac{NOI}{(1+Y)^{3t}+(1+Y)^{2t}+(1+Y)^t+1}\left(\frac{(1+Y)^{3t}}{Y+g_{RR_1}}+\frac{(1+Y)^{2t}}{Y+g_{RR_2}}+\frac{(1+Y)^t}{Y-g_{EC_1}}+\frac{1}{Y-g_{EC_2}}\right)$	Cycle not regular more than one all risk yield rate – overall capitalization rate

Table 2. Comparison between Explicit Growth Model and Cyclical Capitalization.

Dividend Discount Model Traditional Growth Explicit Model	Cyclical Capitalization Model First Version (2001)	Cyclical Capitalization Model Second Version (2003)
	Premise	
There is one *g-factor* representing the combination between the capital and the rent growth	The valuer may estimate a g-factor both in the recession and in the expansion market phase	Property market cycle can be represented by more than two overall capitalization rates, all risk yields
One only growth factor	The valuer knows the temporal length both of the single phase and of the cycle.	The valuer knows the temporal length both of the single phase and of the cycle.
	Inputs	
Discount Rate – Target Rate of return - Equated Yield	Discount Rate – Target Rate of return - Equated Yield	Discount Rate – Target Rate of return - Equated Yield
Rent – Net Operate Income	Rent – Net Operate Income	Rent – Net Operate Income
One g-factor	Two g-factors	More than two g-factors
t =oo	$t_{RR} = t_{EC}$	t
Y > g	$Y > g_{EC}$	$Y > g_{EC}$

$$r=\frac{NOI}{V}=Y-g \tag{24}$$

Using Cyclical Capitalization it is possible to calculate a "dynamic cap rate"

$$V=\frac{(1+Y)^n}{(1+Y)^n+1}\left[\frac{NOI}{Y+g_{RR}}+\frac{NOI}{Y-g_{EC}}\frac{1}{(1+Y)^n}\right] \tag{25}$$

Therefore:

$$V=NOI\frac{(1+Y)^n+1}{(1+Y)^n}(1+Y)^n\left[\frac{(1+Y)^n}{Y+g_{RR}}+\frac{1}{Y-g_{EC}}\right] \tag{26}$$

Finally,

$$R_{CC}=\frac{NOI}{V}=\frac{(1+Y)^n+1}{\left[\frac{1}{Y+g_{RR}}+\frac{1}{Y-g_{EC}}\right]}=\frac{[(1+Y)^n+1][(Y+g_{RR})(Y-g_{EC})]}{(Y-g_{EC})+(Y+g_{RR})} \tag{27}$$

It is clear that the "dynamic" capitalization rate cannot simply be defined as a "… constant annual rate". It takes into account the trend and intensity of the market cycle. Starting from the second version it is possible to write:

$$V=\frac{NOI}{(1+Y)^{3t}+(1+Y)^{2t}+(1+Y)^t+1}\left(\frac{(1+Y)^{3t}}{Y+g_{RR_1}}+\frac{(1+Y)^{2t}}{Y+g_{RR_2}}+\frac{(1+Y)^t}{Y-g_{EC_1}}+\frac{1}{Y-g_{EC_2}}\right) \tag{28}$$

Finally,

$$R_{CDD''}=\frac{NOI}{V}=\frac{\left[(1+Y)^{3t}+(1+Y)^{2t}+(1+Y)^t+1\right]}{\left(\frac{(1+Y)^{3t}}{Y+g_{RR_1}}+\frac{(1+Y)^{2t}}{Y+g_{RR_2}}+\frac{(1+Y)^t}{Y-g_{EC_1}}+\frac{1}{Y-g_{EC_2}}\right)} \tag{29}$$

A first application of Cyclical Capitalization (first version) was carried out in the British real estate market comparing the valuation variation between the values obtained with the first version and those obtained either with the direct capitalization of the Gordon-Shapiro model (1956) or the direct capitalization without explicit growth (d'Amato, 2013).

Subsequently, it was highlighted that the values deriving from cyclical capitalization can be characterized by a tendential prudence (d'Amato, 2015). This peculiarity would suggest the possibility of using cyclical capitalization models in for the valuation of mortgage lending value of commercial properties (d'Amato et al., 2019). The model can include in the valuation also vacancy lag (d'Amato, 2017b).

Furthermore, from 2017, the cyclical capitalization seems to be indicated by the International Valuation Standards as a way to calculate the "exit value" in the discounted cash flow analysis. In fact, for the first time since 2017, the concept of "cyclical asset" was introduced in the international valuation standards. This concept demonstrates the growing important role of the property market cycle in the valuation process. It is specified: "*…for cyclical assets the terminal value should consider the cyclical nature of the asset and should not be performed in a way that assumes "peak" or "trough" levels of cash flow in perpetuity…*" (International Valuation Standards, 2020, paragraph 50.21 letter e). Considering that cyclical capitalization appears to be the only methodology close to this description, the proposed methodological tool is officially recommended from International Valuation Standards. The interest in this methodology may also be justified by the information more and more available in the age of information.

The greater availability of qualitative and quantitative data and information, in aggregate and disaggregated form, with respect to a "local" scale and the easier accessibility, much greater than in the past, allow the valuer to acquire more extensive elements of knowledge and analysis. Traditional technical and economic knowledge of the "comparable" is accompanied, with increasing frequency, by a quantity of complimentary information. They are useful for carrying out the comparison and can contribute to improve the property appraiser's knowledge of the property to be estimated and its market segment. Even in the most recent manuals, the role of these complimentary information is growing. An example may be the calculation of data variable in the Market Comparison Approach or the Segment Comparison Method (MCS), both assuming extra-data, in the valuation process (Simonotti, 2019). Moreover, the analysis of time series can be of help to the estimation of the property market cycle. These analysis are useful for the determination of a plurality of capitalization rates based on recognised procedure such as ARIMA models, now easily executable with the aid of free software available on the net.

4. CONCLUDING REMARKS AND FUTURE DIRECTIONS OF RESEARCH

In this contribution two different variants of cyclical capitalization have been illustrated which may be of interest in the context of real estate valuations extending the scope beyond the determination of the exit value in the context of the estimate for discounting cash flow. Cyclical capitalization models offer the opportunity to determine the value starting either from the historical series of real estate values relating to the segment being valued or on the basis of factual evidence and the ability to formulate forecasts by the valuer. In the former model the market cycle considered is regular, while in the second, irregular market cycles are taken into consideration.

Assessment of the real estate market cycle may assume a strategic role in capitalization models although "*… over the past twenty-five years of research on the subject, authors have recounted numerous reasons for and arguments on the irrelevancy of cycles…. Support for these assertions is based on fundamental concepts embodied in the efficient market hypothesis …*" (Roulac et al., 1999).

A hypothesis that, beyond the integration processes between the financial and real estate market, is incompatible with the characteristics of real estate market.

The proposed analysis also points out the need to develop further insights into the nature of the process of extracting capitalization rates, which allows to lead to an assessment based not on a single and static forecast but on a dynamic approach. A further need that has emerged is to establish the empirical relationships between the selection of capitalization rates and the time series of incomes and prices currently available. If the capitalization rates can be determined subjectively by the valuer, the question arises as to which procedures to use and whether it is possible to entrust the determination of the two (or more) assays to sensitivity analyzes.

In this sense, it may be useful to deepen the study of cyclical capitalization models, not only to broaden the knowledge on a still innovative methodological tool in the context of real estate valuations, but also because these models are consistent with the need to estimate cyclical assets, introduced by the International Valuation Standards in 2017 and confirmed in the IVS 2020. Future research directions may be found in integrating this methodology with the use of trigonometric functions for forecasting the market cycle.

REFERENCES

Associazione Bancaria Italiana (ABI) (2022). Linee guida per la valutazione degli immobili a garanzia delle esposizioni creditizie. Available at: https://www.abi.it/Pagine/Mercati/Crediti/Valutazioni-immobiliari/Linee-guida-valutazioni-immobiliari.aspx (Accessed 8 April 2022).

Amabile, R., & Del Giudice, V. (1997). The contribution of Fuzzy Logic to real estate appraisal. In *Proceedings of European Symposium on Intelligent Techniques*, Bari, (Italy).

Baum, A. (1988). Depreciation and property investment appraisal. In Mac Leary, A., & Nanthakumaran, N. (Eds.). *Property Investment Theory*. London, Spon.

Baum, A. (1991). *Property investment depreciation and obsolescence.* London, Routledge.

Baum, A., & Crosby, N. (1998). *Property investment appraisal.* 2ndEdition. London, Thomson Business Press.

Baum, A., & MacGregor, B. (1992). The initial revealed: explicit valuations and the future of property investment. *Journal of Property Valuation and Investment*, (10), 709–726.

Björklund, K., & Söderberg, B. (1999). Property cycles, speculative bubbles and the gross income multiplier. *Journal of Real Estate Research*, (18), 151–174.

Born, W.L., &Pyhrr, S. A. (1994). Real estate valuation: the effect of market and property cycles. *The Journal of Real Estate Research*, 9(4), 455–485.

Brueggeman, W.B., & Fisher, J.D. (1997). *Real estate finance and investments.* 10th Edition. Boston, USA, Irwin McGraw Hill.

Clapp, J. M. (1993). Dynamics of office markets: empirical findings and research issues. In *American Real Estate and Urban Economics Association Monograph Series*, (N. 1), (Par. 2-3). Washington, DC, The Urban Institute Press.

Clayton, J. (1996). Market fundamentals, risk and the Canadian property cycle: implications for property valuation and investment decisions. *Journal of Real Estate Research*, (12), 347–367.

d'Amato, M. (2001). Dividend Discount Model and property market cycle. In *RICS "The Cutting Edge" meeting*, Oxford, September 2001. Royal Institution of Charthered Surveyors.

d'Amato, M. (2003). Cyclical Dividend Discount Models: linking property market cycles to property valuation. *International Strategic Property Management Journal*, 7(2), 55–69.

d'Amato, M. (2013). Real estate valuation using cyclical capitalization models. *The Valuation Journal*, 8(2), 53–71.

d'Amato, M. (2015). Income approach and property market cycle. *International Journal of Strategic Property Management*, 19(3), 207–219.

d'Amato, M. (2017a). Cyclical capitalization. In Lorenz, D., Dent, P. & Kauko, T. (Eds.). *Value in a changing built environment*. Oxford, Wiley.

d'Amato, M. (2017b). Cyclical capitalization and lag vacancy. *Journal of European Real Estate Research*, 10(2), 211–238.

d'Amato M. (2018). Cyclical Capitalization. In Lorenz, D., Dent, P. & Kauko T. (Eds.) (2018), *Value in a Changing Environment*. Wiley Blackwell, 151–172.

d'Amato, M., Siniak, N., & Mastrodonato, G. (2019). Cyclical assets and cyclical capitalization. *Journal of European Real Estate Research*, 12(2), 267–288.

d'Amato, M., Cabras, A., Lombardi, E., Milazzo, L., Negri, M., Scuderi, M.,Tilli, L., Venturini, F.,& Zulian, G. (2022). Capitalizzazione ciclica. Position Paper Gruppo di Lavoro sulla Capitalizzazione Ciclica di Geo. Val. (nearing completion)

De Lisle, J., & Grissom, T. (2011). Valuation procedure and cycles: an emphasis on down markets. *Journal of Property Investment & Finance*, 29(4/5), 384–427.

Eppli M. (1993). Theory, assumptions, and limitations of direct capitalization. *The Appraisal Journal*, 61(3), 419–425.

Evans, R.D., & Mueller, A.G. (2016). Forecasting real estate cycle risks in portfolios of office properties across cities. *Journal of Real Estate Portfolio Management*, 22(2), 199–215.

Festa, M., Ghiraldo, E., & Storniolo, A. (2012). Analysis of real estate market cycles: an application on Italian data. In *Atti del XLI Incontro di Studio del Ce.S.E.T.*, Roma, Italia, 105–125.

French, N. (2019). Predicted property investment returns: risk and growth models. *Journal of Property Investment and Finance*, 37(6), 580–588.

Forte, C. (1968). *Elementi di Estimo Urbano.*Milano, Etas.

Gehr, A.K. (1992). A bias in Dividend Discount Models. *Financial Analysts Journal*, 48(1), 75–80.

Giammaria, V., Bambagioni, G., & Simonotti, M. (2017). *Codice delle valutazioni immobiliari. Italian property valuation standard*. Roma, Tecnoborsa S.c.p.a. Consorzio per lo Sviluppo del Mercato Immobiliare.

Gordon, M. J. (1963). *The Investment, Financing and Valuation of the Corporation*. Homewood, Ill., R. D. Irwin.

Gordon, M. J., & Shapiro, E. (1956). Capital equipment analysis: the required rate of profit. *Management Science*, 3(1), 102–110.

Grebler, L., & Burns, L.S. (1982). Construction cycles in the United States since World War II. *Real Estate Economics*, 10(2),123–151.

Grover, R., & Grover, C. (2014). Property bubbles a transitory phenomenon. *Journal of Property Investment & Finance*, 32(2), 208–222

Hendershott, P. H. (1996). Rental adjustment and valuation in overbuilt markets: evidence from the Sidney Office Market. *Journal of Urban Economics*, 39(1), 51–67.

Hekman, J.S. (1985). rental price adjustment and investment in office markets. *Journal of the American Real Estate and Urban Economics Association*, 13(1), 32–47.

Hickman, K., & Petry G.H. (1990). A comparison of stock price predictions using court accepted formulas Dividend Discount and P/E Models. *Financial Management*, 19(2), 76–87.

Hoyt, H. (1933). One hundred years of land values in Chicago: the relationship of the growth of Chicago to the rise in its land values, 1830-1933. Chicago, University of Chicago Press.

International Valuation Standards Council (IVS) (2020). International Valuation Standards. Effective 31 January 2020, International Valuation Standards, London.

Jacobs, B.I. & Levy, K.N. (1988). On the value of 'value'. *Financial Analysts Journal*, 44(4), 47–62.

Kampf Dern, A., Roulac, S.E., & Pyhrr, S.A. (2018). Are there cycles in real estate cycles research? evidence from 30 years of papers presented at Real Estate Society meetings. *Journal of Real Estate Literature*, 26(1), 43–80.

Kuznets, S. (1930). Secular movements in production and prices. New York, NY, Houghton Mifflin.

Malpezzi, S., & Wachter, S.M. (2005). The role of speculation in real estate cycles. *Journal of Real Estate Literature*, 13(2), 143–162.

McCough, T., & Tsolacos, S. (1995). Forecasting commercial rental values using ARIMA Models. *Journal of Property Valuation and Investment*, 13(5), 6–22.

Mueller, G.R., & Laposa, S.P. (1994). Evaluating real estate markets using cycles analyses. In *1994 Annual Meeting*, April, 1994, Santa Barbara, CA. American Real Estate Society.

Mueller, G. R., & Laposa, S. (1996). Rent distributions under alternative market cycles. In *1996 Twelfth Annual Meeting*, March 28,1996, South Lake, Tahoe, CA. American Real Estate Society.

Peiser, R.B. (1983). Capitalization rates, inflation and investment analysis in U.S. real estate. *Appraisal Review Journal*, Spring-Summer, 42–49.

Payne, T.H., & Finch, J.H. (1999). Effective teaching and use of the constant growth dividend discount model. *Financial Service Review*,8(4), 283–291.

Pyhrr, S. A., Webb, J. R., & Born, W. L. (1990). Analyzing real estate asset performance during periods of market disequilibrium under cyclical economic conditions: a framework for analysis. In Kapplin, S. D., & Schwartz, A. L. Jr., (Eds). *Research in Real Estate*, (3), JAI Press, pp. 75–106.

Pyhrr, S. A., Webb, J. R., & Born, W. L. Manning C. A. (2003). Project and portfolio management decisions: a framework and body of knowledge model for cycle research. *Journal of Real Estate Portfolio Management*, 9(1), 1–16.

Roulac, S.E. (1996). Real estate market cycles, transformation forces and structural change. *The Journal of Real Estate Portfolio Management*, 2(1), 1–17.

Roulac, S.E., Pyhrr, S.A., & Born, W.L. (1999). Real Estate market cycles and their strategic implications for investors and portfolio managers in the global economy. *Journal of Real Estate Research*, 18(1), 7–68.

Simonotti, M. (1997). *La stima immobiliare*. Torino, Utet.

Simonotti, M. (2019). *Valutazione immobiliare standard. Nuovi Metodi*. Mantova, Stimatrix.

Smith, H.C., Ling, D.C., & Corgel, J.B. (1998). *Real estate perspectives*. Irwin McGraw-Hill.

Voith, R., & Crone, T. (1988). National vacancy rates and the persistence of shocks in the U.S. office markets. *Journal of the American Real Estate and Urban Economics Association*, 16(4), 437–458.

Webb, J. (1995). The characteristics of real estate returns and their estimation. In Pagliari, J.L. (Ed.). *The Handbook of Real Estate Portfolio Management*. Chicago, Irwin Professional Publishing.

Webb, J., Irwin S.H., &Landa, D. (1987). Real estate futures and gold as portfolio assets. *Journal of Portfolio Management*, 14(1), 29–34.

Wheaton, W.C. (1987). The cyclical behaviour of the national office market. *AREUEA Journal*, 15(4), 281–299.

Witckiewicz, W. (2002) The use of the HP-filter in constructing real estate cycle indicators. *Journal of Real Estate Research*, 23(1-2), 65–88.

Witten, R. G. (1987). Riding the inflation cycle. *Real Estate Today*, August, 42–8.