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Application of a Cyclical Capitalization Model to the London Office Market

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Whilst the property market shows cyclical behaviours, opinions of value based on income approaches assume that there is stable or perpetually growing (or decreasing) income without considering the effects of the property market cycle on leasing contracts. The paper therefore focuses on the application of a valuation method for income producing properties which have a value that is affected by the upturns and downturns of property market cycles. Continuing from the previous works in this area (d'Amato, 2003, d'Amato, 2013; d'Amato, 2015) the income approach method here is applied to the office market in four areas of London. In applying this valuation method, property valuation and time series analysis are integrated. The work provides a general introduction on cyclical capitalization as another family of valuation methodologies based on the income approach and then an application of cyclical capitalization to areas of London which highlight their strength and weakness.

Keywords

Real Estate Market Cycle; Cyclical Capitalization; Direct Capitalization

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1. Introduction

Income producing properties are normally appraised by using income approaches that "…*provides an indication of value by converting future cash flow to a single current value" (*International Valuation Standards Council 2017).

Real estate appraisers often define a set of market conditions, and economic trends are assumed to remain stable into the future when delivering this kind of valuation. For this reason, appraisers may overstate or understate value because they fail to consider the impacts of economic and market cycle variables (Pyhrr et al., 1996) in the valuation process. After the non-agency mortgage crisis, understanding of the market cycle has become more and more important in both the literature and professional real estate documents. The recurring hypothesis of either a constant or an always increasing rent is nothing more than an implicit assumption, and has become a "passive way of thinking" in the valuation process. The consequences of these hypotheses in term of the opinion of value are quite evident: there are increasing more boom and bust effects in the property valuation process. This passivity has affected the financial sectors of the economy because it is now found in the real estate industry. Assuming that there is a constant net operating income in a recession means extending this assumption to other phases of the real estate market. This is what happens when it is assumed that rent is constant or ever growing in a specific market phase.

The paper therefore proposes the application of a model that belongs to a wider group of income approach methodologies called cyclical capitalization (d'Amato, 2003; d'Amato, 2013; d'Amato 2015; Renigier-Bilozor and d'Amato, 2017; d'Amato, 2017a; d'Amato, 2017b). The proposed method integrates two income approaches (direct and yield capitalization) and a real estate market cycle analysis. The work is organized as follows: Section 2 will provide a literature review on real estate market cycles. The role of real estate market cycles lies in the valuation of real estate as demonstrated by professional valuation standards. An introductory analysis on an income approach and cyclical capitalization techniques will be provided in Section 3. In Section 4, the cyclical capitalization method will be applied to the office market in four London urban areas. Final remarks will conclude the article.

2. Market Cycle and Property Valuation

Analyses of real estate market cycles began with the pioneering work of Kuznets (1930) who describes swings as a medium range economic cycle that is 15-25 years and related to immigrant inflows and outflows and the consequent changes in construction activity.

Hoyt (1933) analyses land values in Chicago between 1830 and 1933. He describes several cyclical movements such as population growth, rent levels, operating costs of buildings, land values and subdivisions of land parcels. All of these forces are mutually reinforcing. Grebler and Burns (1982) analyse six residential and four non-residential construction cycles in the U.S. between 1950 and 1978. Research work on the price-income relationship allowed Björklund and Söderberg (1999) to find that the vacancy rate is the best indicator of a property cycle. Hekman (1985) observes the office sector in fourteen cities in a period that started in 1979 and ended 1983. He empirically demonstrates that the office construction sector is cyclical. Cyclicality of vacancy rates among the different metropolitan areas has been demonstrated by Voith and Crone (1988) after observing office market vacancy rates in seventeen large metropolitan areas in the U.S. Case and Shiller (1989) and Borio *et al*. (1994), demonstrate the cyclical nature of real estate prices.

Born and Pyhrr (1990) provide a fundamental overview on the role of the market cycle in a real estate market analysis. Dokko *et al*.(1991) show how local market and macroeconomic conditions move together to generate cyclical outcomes for local real estate markets. Grenadier (1995) examines the causes of prolonged cycles, or persistence, in property markets, while Roulac (1996) provides a fundamental qualitative study on the importance of cyclical relationships, and concludes that real estate markets are influenced by the economy, office demand, office construction, property values, volume of transactions, capital for real estate, investor interest and tax climate factors. In analyzing Canadian commercial property prices, Clayton (1996) demonstrates that major market cycles can be forecasted before they occur, which provides arbitrage opportunity. Mueller and Laposa (1996) focus on rent distributions in different market cycle phases. Renaud (1997), prompted by the phenomenal effect of the globalization of financial markets on property markets around the world, documents international and domestic factors that contribute to this strong global property cycle. Green (1997) performs tests for causality between economic and real estate investment cycles. Björklund and Söderberg (1999) in examining the Swedish property market cycles, discover that this market has been influenced by a speculative bubble in the 1980s.

Dokko et al. (1999) provide a new property cycle model based on the relationship between property value and net operating income. In their analysis, twenty office markets show several types of cyclical behaviours. Grissom and DeLisle (1999) provide a macro-economic approach to examine the real estate market cycle with gross national product (GNP), interest rate, unanticipated inflation, tax shelter and capital gains. Roulac et al. (1999) address the importance of the market cycle for investment and portfolio management. Property cycles seem to be correlated to different types of economic cycles and become more volatile in periods of speculation (Witkiewicz, 2002; Wheaton, 1999). Wang (2000) shows that there are no bubbles in the office, retail and aggregate property cycles in the U.K., starting from the relationship between capital value and rent. An interesting attempt to integrate the real estate market

cycle into the real estate management process is found in Rottke et al. (2003). An analysis of the relationship between property and other related sectors shows how property market swings more severely than the economy as a whole. Furthermore, the fluctuations in the property market can be seen as moderately relative to those in the housing market (Wang, 2003).

The role of speculation in real estate cycles has been analysed by Malpezzi and Watcher (2005). In their paper, they show that land speculation is primarily due to property market cycles. According to Reed and Wu (2010), property cycle research can increase the awareness of low-income homeowners on the characteristics of cycles and associated risks of each residential investment. By analysing property prices in Hong Kong, Funcke and Paetz (2013) observed how property prices are motivated by the unease towards intratemporal preference rather than financial friction. Others have made efforts to determine the temporal length of the property market cycle, and observed four different kinds of cycles: a three to five year inventory cycle called the Kitchin cycle; a seven to eleven year cycle associated with fixed investment called the Juglar cycle; a fifteen to twenty-five year long swing associated with population changes or transport infrastructure investments called the Kuznets cycle; and a forty-five to fifty year long wave associated with major innovations called the Kondratiev cycle (Grover and Grover, 2013).

Scott and Judge (2000) examine British commercial property values between 1956 and 1996 suggested a property cycle of 7.8 years which consists of a three year interval between development starts and completions. Barras (2009) observes four building cycles of different durations: an endogenously generated major building cycle of eight to 10 years; a minor cycle of four to five years which reflect the demand influence of the business cycle; a long wave of 40-50 years caused by the impact of technological revolutions; and finally, a cycle of 15-20 years in length which is subjected to pressure from speculative investment and boom-bust cycles. Ball and Grilli (1997) identify two different cycles in the commercial property market: a former long cycle that ran from 1955 to 1980 and a latter shorter one from 1980 to 1996. The most significant component of these contributions is their focus on the role of the market cycle at the micro and macro levels and trying to determine the cause and effects of the property market cycle without reference to property valuation methods.

In many studies in the extant literature, a prediction of the temporal length of the property market cycle is instead provided. However, after the non-agency mortgage crisis, the effects of the property market cycle have been increasingly taken into consideration, even in the international standards of professional valuers. From a valuation point of view, traditional valuation techniques can be successfully applied during stable times and periods of even growth, but are less successful and even fail during down market times (DeLisle and Grissom, 2011). According to the Appraisal of Real Estate 13th Edition, one of the leading professional books on real estate valuation in the US based on the income approach, "*...Historical income and current income are significant, but*

the ultimate concern is the future" (Appraisal Institute 2008, p.469-470). Guide Note 12 Analyzing Market Trend states that *"(w)hile appraisers generally analyze historic data (e.g. comparable sales) in the valuation process, it is important to recognize that the value of a property is dependent on the future benefits that a property will bring to its owner. Future benefits include the rights to use, occupy, and enjoy the property as well as the right to receive income it may produce. Market values are therefore forward-looking…*" (Appraisal Institute 2013, p.42). Standards Rule 1-4 of the United States Professional Appraisal Practice (USPAP) states that appraisal of property value is based on the income approach so that the appraiser has to"*… (iv) base projections of future rent and/or income potential and expenses on reasonably clear and appropriate evidence…*" (The Appraisal Foundation 2015).

Furthermore, the role of market trends are stressed in Advisory Opinion 34. which states that in *"... a prospective appraisal, the appraiser analyzes market trends to provide support for forecasted income and expense or sell-out opinions, absorption periods, capitalization rates, and discount rates as of the effective date of the appraisal. Economic trends such as growth in population, employment, and future competition are also analyzed. The overall economic climate and variations in the business cycle should be considered and weighed in the performance of the appraisal process…*" (The Appraisal Foundation 2015 p.194). The role of the cycle is also stressed in the European Valuation Standards 2016. In regard to the assessment of a fair value, European Valuation Information Paper (EVIP) 8 observes that "*…the quantity, quality and reliability of the evidence will also vary according to where the valuation date falls in the market cycle. For example, a downward phase of the cycle often starts with a period of much reduced market activity in which few transactions take place and thus little evidence is available to the valuer…."* (TEGoVA 2016, p.348).

In the same standard, the role of the market cycle is recalled in another chapter on mortgage lending value. In particular, the European Valuation Guidance Notes (EVGN) 2 (Valuation for Lending Purposes) states that "*…The valuer has to identify situations where current values reflect short term demand due to market inefficiencies such as may arise in the development cycle (shortage of supply of a property type followed by oversupply) or where identifiable factors such as consumer taste distort a market so that future marketability is at risk*" (TEGoVA 2016, p.105). The problem can also be observed in the assessment of worth. In fact, in the application of a discounted cash flow (DCF) analysis for investment purposes, scrap value calculation may be a critical problem. The main assumptions of the DCF are often based on the perception of risk. For this reason, it has been stated "*…Income and capital growth assumptions, and their relationship with perceived levels of risk, are central to the investor's decision making process. The higher the probability of an investment failing to deliver anticipated cash flow returns (i.e. the higher the risk), the higher the return that the investor will demand…*" (Bywater,2011,p.5)

The last International Valuation Standards (International Valuation Standards Council 2017) introduced for the first time a concept that formulates a close relationship between the valuation activity and property market cycle analysis. In the central part of the standard, which is the 105 Valuation Methods and Approaches and in particular, in the income approach, is the recurring definition of "cyclical asset". In the income approach, the standards indicate that *"…in the valuation of cyclical asset, the explicit forecast period should generally include an entire cycle, when possible…"* (International Valuation Standards Council 2017, p.39). Furthermore in the calculation of the terminal value, it is indicated that "…*for cyclical assets, the terminal value should consider the cyclical nature of the asset and should not be performed in a way that assumes "peaks" or trough levels of cash flow in perpetuity*…" (International Valuation Standards Council 2017, p.41).

That being said, a problem that may arise is how to include property market cycle analysis in the appraisal of value based on the income approach. Also, there is the question of how to theoretically and methodologically bridge analyses of property market cycles which have a large and significant literature and professional valuation practices. Finally, there is the question of how to surpass "latent thinking" which considers that a real estate market is always increasing or does not change with time.

The relationship between value and property market cycles is particularly evident for income producing properties that are more seriously affected by market upturns and downturns. These properties are usually appraised by using the income approach. Unfortunately, the appraisers assume that rent is constant or always increasing. This assumption is premised on the models under the income approach provided by the standards of the valuation profession. This not only limits the property valuation method but gradually, the assumption becomes widely accepted as the norm. Pollock (2011,p.3) stresses that " …*Bubbles are the unsustainable increase in the price of some asset (houses, most recently) that people end up buying because they believe the price will continue to rise*". It should be noted that this may be partially caused by the recurring valuation methodology used which assumes a constant or ever increasing rent. For this reason, the work here uses a proposed group of income approach methodologies that integrate property market cycle analysis with valuation methods. These methodologies, which originally defined the cyclical dividend discount (DD) models (d'Amato, 2003), have become part of a much wider group of recent methodologies that have redefined the cyclical capitalization models (d'Amato, 2013; 2015a; 2017a; 2017b). These models are proposed for the valuation of income producing properties affected by the upturns and downturns of property market cycles and even applied to appraise the exit value in a DCF analysis too.

3. Income Approach and Cyclical Capitalization Methods

The attempt to integrate real estate market cycles with property valuation is not a new concept. In his work on determining the overall capitalization rate, Kazdin (1944) addresses the importance of including business cycles in calculating the capitalization rate. However, the first attempt to include property market cycles in an analysis was in Bow et al. (1994). Their work laid the fundamentals for examining the relationship between property market cycles and valuation. They emphasize that: "*Explicit in "traditional" appraisal analyses is the presumption that both stabilized income and the overall capitalization rate are constant in every period in perpetuity. In contrast, "modern" appraisal analysis incorporates DCF analysis but usually makes three heroic assumptions: (1) constant rates of change in rents and operating expenses over time, (2) a constant overall capitalization rate to convert NOI into market value at the end of the projection period (generally ten years) and (3) a stabilized vacancy rate over the projection period. This is a static modelling that is incompatible with the dynamic market it seeks to measure*" (Bow et al.,1994 p.456). Dokko et al. (1999) further attempt to build "…*a theory of real estate cycles that demonstrates the interrelationships among the economic cycle, real estate rental rates and property value cycles over time*".

Herein econometric modelling is used for determining the opinion of value. Cyclical capitalization also incorporates econometric modelling for value determination. Cyclical capitalization allows an appraiser to include an analysis of real estate market cycles when delivering an opinion on value thus removing "latent thinking"; that is, the view that there is a stable or ever growing real estate market. The income approach belongs to a family of business valuation methodologies. In the International Valuation Standards 2017, the income approach in general has: *"…methods….effectively based on discounting future amounts of cash flow to present value. They are variations of the Discounted Cash Flow (DCF) method"* (International Valuation Standards Council 2017). Assuming a holding period equal to 0, the opinion of value will coincide with the terminal value (exit or scrap value). This is also called direct capitalization.

Direct capitalization consists of dividing the net operating income or other definitions of income or generally speaking, the rent of a property for an appropriate capitalization factor or overall capitalization rate. Equation 1 calculates direct capitalization:

$$V = \frac{NOI}{R} \tag{1}$$

where *NOI* is the net operating income, and *R* is the overall capitalization rate. The overall capitalization rate can be calculated in several ways. It is possible to use, among others: the market extraction method, band of investment analysis for land and building (Ross,1937), band of investment analysis for mortgage equity (Kazdin, 1944) and underwriter's method (Gettel,1978).

Direct capitalization can be calculated by using an explicit growth model to apply the well known DD model (Gordon and Shapiro, 1956; Gordon,1962) as indicated in Equation 2:

$$V = \frac{NOI}{Y - g} = \frac{NOI}{Y - \Delta a} \tag{2}$$

where *NOI* denotes the net operating income which can be calculated by using both current and predicted rent. The capitalization rate is the difference between *Y* or the discount rate and the growth (*g*) factor which can also be defined as Δa and represents the rate of growth both in terms of rent and property value. The terms have been defined in The Appraisal of Real Estate, 13th Edition as "…*adjustment rate that reflects the total change or growth in income and value*…" (Appraisal Institute 2008, p.532). In particular, Δa is the product between the rate of change Δ and a sinking fund factor *a* (or recapture rate) to convert the total relative change referred to the remaining economic life in income and value into a periodic rate of change depending on the rate of variation both in terms of property price and rent.

In cyclical capitalization, the importance of the phase of the cycle is more than the accrued depreciation of the property. The calculation of Δa can refer to the site or building separately or the entire property (Corgel et al.,1998). On the other hand, *Y* is a discount rate which can be calculated by using single or multifactor (Sharpe,1966; Ross, 1976) market data, and risk adjusted discount rates. The product can be described with Equation 3:

$$\Delta a = \Delta \frac{Y}{(1+Y)^t - 1} \tag{3}$$

where *Y* is the discount rate, Δ is the rate of change in terms of rent and property value variations, and *a* is the recapture rate that transforms this variation into an annual effect. There are different approaches for calculating *Y*. The techniques applied when the asset value of the investment decreases to zero over the holding period in the DCF are normally based on either the Inwood or Hoskold premise.

The Inwood premise "…*assumes a constant rate of return on capital each year with the return of capital being reinvested in a sinking fund at the same yield rate as Y*…" (Appraisal Institute 2008, p.660) by using only one discount rate. On the other hand, the application of the Hoskold premise uses two different rates. One of the rates is "*a speculative rate representing a fair rate of return on capital commensurate with the risks involved*" (Appraisal Institute 2008, p.661) whilst the second rate is "…*to replace the asset at the end of the holding period*..." (Appraisal Institute 2008, p.661). Cyclical capitalization works in a different way by using the g factor to plot the local property market cycle. In cyclical capitalization, the time series of the rates of change of price and rent are divided into several "slices of value" according to observed real estate

market phases. In the application of these models, the appraiser must select an appropriate holding period to observe and calculate the rates of change in terms of property value and rent variations in each real estate market phase. This holding period looks at the past instead of the future like in the DCF analysis. For this reason, it has been defined as a *backward holding period* (d'Amato, 2013; d'Amato, 2015; d'Amato, 2017a; d'Amato, 2017b).

In the DCF analysis, the holding period is a temporal forecast of future rents and costs before determining the exit value. In cyclical capitalization, the holding period is the interval of time for observing previous rents and the rate of the change in value in order to forecast their cyclical behaviour for each property market phase. In the DCF analysis, the holding period looks at the future, whilst in cyclical capitalization, the backward holding period looks at the past. The application of cyclical capitalization assumes that cyclical behaviour in the past will be approximately repeated in the future. As a consequence, there will be a different meanings of the *g*-factor or Δa. The rate of change of cyclical capitalization Δa is calculated based on real data during the temporal length of a single phase of the cycle in the backward holding period. It may also be calculated by using the rate of change of contractual rent. The use of the professional expertise of property market valuers is a further alternative. The adjustment rate reflects the moderate change or growth in income and value in a single phase of the property market cycle.

Among several possible definitions of the property market phases, the cycle will be defined primarily with expansion, contraction, recession, and recovery (Mueller and Laposa, 1994) in this paper. Equation 4 below considers determining Δa_{EC} in a phase of expansion contraction (EC) with a temporal length of *t*:

$$\Delta_{EC} a_{EC} = \Delta_{EC} \frac{Y}{(1+Y)^t - 1} \tag{4}$$

where Δa_{EC} is the product between the rate of change in the phase of EC with the sinking fund factor or recapture rate for the length of *t* of the market phase, and Y is the discount rate. More than one market phase could be observed in the backward holding period. Therefore, the method will be based on more than one overall capitalization rate according to the different phases of the property market. In the initial version of the method (d'Amato, 2003), there were two different property market cycle phases: one is negative and called the recession-recovery (-) phase, and the other is positive and called the expansion-contraction (+) phase. Assuming that a complete cycle is the sum of the negative phase of recession recovery (-) and a positive phase of expansion contraction (+), the opinion of value will be the sum of different "intervals" or alternative phases with different g-factors or Δa rates of change. Therefore, the value of an income producing property can be expressed as the sum of the different intervals of the market phases that have overall different capitalization rates.

By using the direct capitalization model as indicated in Equation 2, the value of the property in the recession recovery (-) phase in which the length is t_{rr} can be expressed as follows:

$$Y_{PhaseRR} = \frac{NOI}{Y-(-\Delta a_{RR})} - \frac{NOI}{Y-(-\Delta a_{RR})}\frac{1}{(1+Y)^{trr}} \tag{5}$$

Summing up a second phase of the expansion contraction (+) to complete the cycle will result in Equation 6:

$$V_{PhaseRR+PhaseEC} = \frac{NOI}{Y-(-\Delta a_{RR})} - \frac{NOI}{Y-(-\Delta a_{RR})}\frac{1}{(1+Y)^{trr}} + \frac{NOI}{Y-\left(+\Delta a_{EC}\right)}\frac{1}{(1+Y)^{tec+trr}} - \frac{NOI}{Y+\left(-\Delta a_{EC}\right)}\frac{1}{(1+Y)^{tec+2trr}} \tag{6}$$

where t_{RR} denotes the temporal length of the recovery recession phase, and t_{EC} the temporal length of the expansion contraction phase. Considering an equal temporal length n of the phases t_{rr} and $t_{ec} = n$, it is possible to write Equation 7 below:

$$V = \left[\frac{NOI}{Y-(-\Delta a_{RR})} + \frac{NOI}{Y-\left(+\Delta a_{EC}\right)}\frac{1}{(1+Y)^{n}}\right]\left(1 - \frac{1}{(1+Y)^{n}} + \frac{1}{(1+Y)^{2n}} - \frac{1}{(1+Y)^{3n}}\ldots\right) \tag{7}$$

The second part of Equation 4 is the *infinite* geometric progression of rate *r* equal to $-1/(1+Y)^n$, in which the r term is included in the following interval: $-1 < r < 1$; therefore the infinite geometric progression will tend towards the following:

$$\sum_{i=1}^{\infty} r_i = \frac{1}{1-r} \quad \text{where } r = -\frac{1}{(1+Y)^{n}} \tag{8}$$

Finally, the value of the perpetuity can be calculated with Equation 9:

$$V = \frac{NOI(1+Y)^{n}}{(1+Y)^{n}+1}\left[\frac{1}{Y-\left(-\Delta a_{RR}\right)} + \frac{1}{Y-\left(+\Delta a_{EC}\right)}\frac{1}{(1+Y)^{n}}\right] \tag{9}$$

where *NOI* is the net operating income, and there are two different *g*-factors or Δa terms. One is related to the recovery recession phase, whilst the other is related to the expansion contraction phase. *Y* is the discount rate and *n* is the temporal length of the two phases of the cycle. The model uses two different overall capitalization rates instead of one. In a similar way, the approach could be applicable to direct capitalisation as show in Equation 1. This model can be suitable for cases in which the variations in terms of rent and price *in* a single phase are not significant. The model based on Equation 1 of direct capitalization can be written as follows:

$$V = \frac{NOI(1+Y)^{n}}{(1+Y)^{n}+1}\left[\frac{1}{R_{RR}} + \frac{1}{R_{EC}}\frac{1}{(1+Y)^{n}}\right] \tag{10}$$

where *NOI* is the net operating income, Y is the discount rate, R_{RR} is the overall capitalization rate in the recovery recession phase and R_{EC} is the overall capitalization rate in the expansion contraction phase. Clearly, cyclical capitalization should be applied in the property market segments in which the value is influenced by upturns and downturns of the property market cycle. A further methodological premise is in the variation of the rates of change in rent and property price *between* (or outside a single phase) the property market phases. Obviously, they must be significant; otherwise, the conventional direct capitalization model will be a better choice. Cyclical capitalization may also be used to define the exit value in a DCF analysis in both real property and the valuation of trade related properties. The proposed method can be considered as an appropriate way to deal with the future trends of the property market cycle in a more realistic way. Although cyclical capitalization is part of a wider (d'Amato,2017c) group of income approach methodologies that link the opinion of value to the property market cycle, in this paper only two models have been highlighted and the selection of the most appropriate model depends on the nature and the characteristics of the property market cycle.

4. Application of Cyclical Capitalization to London Office Market

The application of cyclical capitalization is carried out in two parts. In the first part, a time series analysis is carried out to determine the rate of change in rent and property price in the backward holding period. It is also possible to replace this analysis with the personal expertise of valuers in a specific market segment. This phase is very important for observing the cycle, and determining the appropriate income model. Observing the property market cycle can help an appraiser to decide whether it is necessary to apply Equation 9 or 10. Equation 9 is applicable if the rate if change *in* a property market phase is significant. Equation 10 is applicable in the event the rate of change *in* a single market phase (expansion contraction or recovery recession) is not meaningful.

A further result of this analysis is the calculation of the temporal length of the phases and the rate of change. As previously mentioned, the local expertise of property valuers can be utilized in this phase, and if so, the personal experience of the valuers would be used in lieu of a time series analysis. In this article, the application of cyclical capitalization will start with a time series analysis. An autoregressive integrated moving average (ARIMA) model will be applied to analyse the time series for each of the specified four areas of the London office market (Wilson and Okunev, 1998). Cyclical capitalization will also be applied to the office market in the following four areas of London: *sub urban London (SL); southeast London (SEL); southwest London (SWL);* and finally *City of London (CL).* The author is grateful to CB Richard Ellis London for providing the time series for prime rent in the office sector. The data are available for all of the urban areas from the third quarter of 1972 to first quarter of 2008. They

are appraisal based and referred to as freehold properties in a prime location in the office market. All of the information came from an analysis of real transactions of high quality office units with a standard size of 1000 sqm. In order to observe the phases of the cycle, the focus is on the prime rent. Figure 1 shows the time series of the rate of change in prime rents in the four studied areas of London.

The considered rate of change in the time series is calculated as follows:

$$\Delta = \frac{R_{t+1} - R_t}{R_t} \tag{12}$$

where R_t denotes the prime rent at time t, and R_{t+1} the prime rent at time $t+1$. It is assumed that the rate of change of rent is also significant for the rate of change of property price.

This rate of change is calculated in a time interval that starts from the third quarter of 1972 and the first quarter of 2008. Figure 2 shows the time series for the rate of change in the backward holding period from 1998 to 2008. A backward holding period of 10 years is assumed because it is clearly possible to observe both the recovery recession and the expansion contraction phases of the cycle in the four areas of the London office market.

Then, an ARIMA analysis is carried out on the four time series. ARIMA modeling is not new to real estate time series analysis (Chin and Fan 2005) even if there are just a few studies that analyze the historical movement of property price, their dynamics and future changes (Tse,1997). In this case, four ARIMA models are analyzed for the four London office areas.

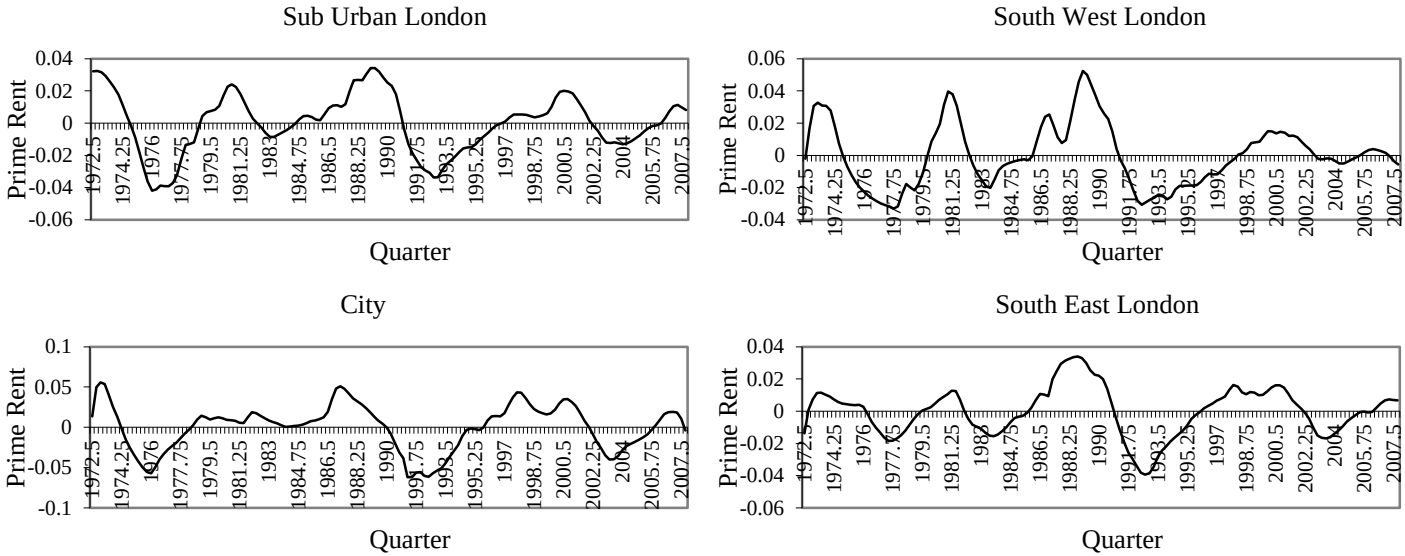
Table 1 Four ARIMA model of Rent Variation in the Four Office Property Markets in London

	London Office District			
	SEL	SL	SWL	C
ARIMA (p,d,q)	1,1,0	1,1,0	0,1,0	1,1,0

Note: sub urban London (SL); southeast London (SEL); southwest London (SWL); and City of London (C).

All of the models passed both the Box Ljung and the Box Pierce tests. The backward holding period of the phase has been observed in the interval between 1998:2 and 2008:1 for all four studied areas of the London office market. An estimation of the temporal length of both of the expansion contraction and recovery recession phases for all four property market areas of London is provided in Table 2.

Figure 1 Rate of Change in Temporal Interval 1972:3 – 2008:1



Source: CB Richard Ellis London. Author's elaboration

Figure 2 **Rate of Change in Backward Holding Period for Four Areas of London Office Market (Prime Locations)**

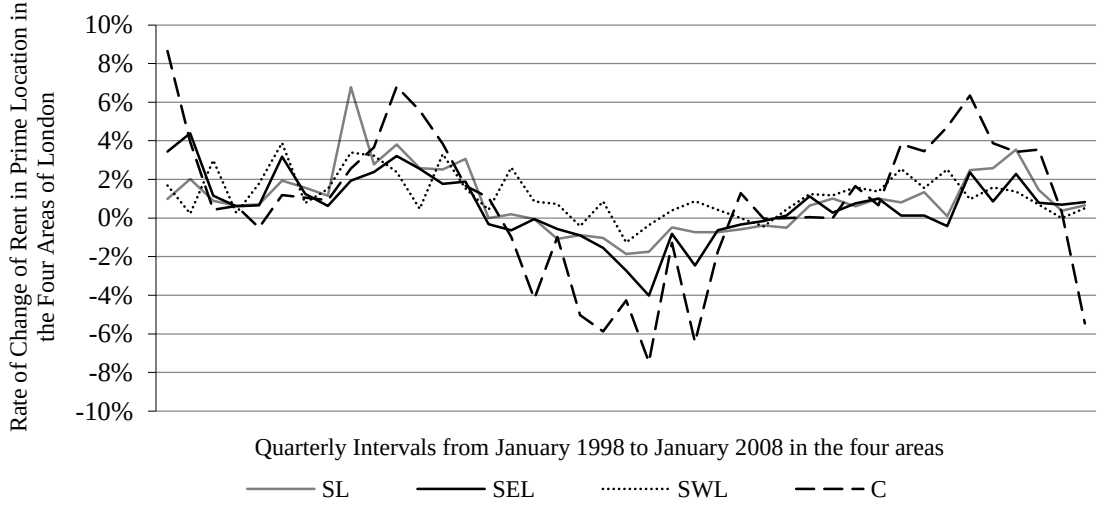


Table 2 Length of Phase in terms of Number of Quarters for Each Area of London Office Property Market.

Phases SL office market Temporal length in quarter of the phase in the backward holding period				
1st phase	2nd phase	3rd phase	Arithmetic	
EC	RR	EC	Mean	t
17	11	12	13.3	4
Phases SEL office market Temporal length in quarter of the phase in the backward holding period				
1st phase	2nd phase	3rd phase	Arithmetic	
EC	RR	EC	Mean	t
15	13	12	13.3	4
Phases SWL office market Temporal length in quarter of the phase in the backward holding period				
1st phase	2nd phase	3rd phase	Arithmetic	
EC	RR	EC	Mean	t
18	9	12	13	4
Phases C office market Temporal length in quarter of the phase in the backward holding period				
1st phase	2nd phase	3rd phase	Arithmetic	
EC	RR	EC	Mean	t
12	13	15	13.3	4

Note: sub urban London (SL); southeast London (SEL); southwest London (SWL); and City of London (C).

The *backward holding period* starts 1998:2 and ends 2008:1 for all four studied areas of London. Three different market phases can be observed with a similar length, and can be defined as the Kitchin cycle because of the duration. There is a first positive phase of expansion contraction, then a second negative recovery recession phase and finally another positive phase of expansion contraction. It is worth pointing out that the temporal length of these phases is always about thirteen quarters (say four years). Table 3 shows the annual rate of the variation in rent calculated with the ARIMA models in the four areas of the office market of London.

Table 3 addresses the four areas taken into account. In the SL, the two expansion contraction phases of the market have an annual variation of 0.076 and 0.051 respectively. In the same area, the annual variation of the phase of the recovery recession is -0.036. The temporal length of each phase indicated in Table 2 is four years. In the SEL, the former expansion contraction phase presents an annual variation of 0.078 and the latter expansion contraction phase, an annual variation ratio of 0.0289. In the same area, the recovery recession phase presents only one phase with a variation ratio of -0.0488. In this area, the temporal length of each phase is always four years. In the SWL, the expansion contraction phase has the following annual rates of change: 0.0718 and 0.0553. The negative phase has a rate of change of -0.00078. As shown in Table 2, the

length of the phase is always approximately four years. Finally, C shows two positive annual rates of change: 0.0977 and 0.0722. In the same area, the negative annual rate of change is equal to -0.10796. This is the area with the highest level of variation. Like the others, the moderate length of a temporal phase of the market cycle is four years. At this stage, the temporal length of both the recovery recession and expansion contraction phases is known. The variation rate for each property market phase in every area of London has been determined. In the normal application of the DD model to the real estate valuation process, the g factor is calculated as the product of Δa or the product between the rate of change Δ of the property price and rent, and a sinking fund factor or recapture rate *a* for the holding period. In the application of cyclical capitalization, this product is related to the variations in the property price and rent in a single real estate market phase and the recapture rate is related to the specific temporal length of the phase both negative (herein dubbed recession recovery) and positive (defined as expansion contraction). In this method, the focus is not on the physical aspects of the property but on the dynamics of its rent. As indicated in Table 2, there are different temporal lengths and rates of variation in each area of the London office market. The choice between the two different models presented in this work is based on the intensity of the rate of change. If the variation in each phase is different from 0, the suitable model for the application will be the one indicated in Equation 9. Otherwise, the model proposed in Equation 10 will be much more suitable. Another important consideration is that cyclical capitalization should be applied in contexts which also have significantly different variations in the rate of change among the cyclical phases; otherwise, conventional direct capitalization remains the best solution. Therefore, these methods do not replace any existing ones. They only represent a further methodological opportunity for the valuation of income producing properties affected by the property market cycle. In Table 3, the calculation of the cap rate in different market phases has been carried out by using the observed rates of variation and assuming a discount rate that varies from 0.04 to 0.19. Table 4 provides the calculation of the two overall cap rates in the two different market phases - expansion contraction(+) and recovery recession (-) for the office market area of *SL*.

The second column *Y* of Table 4 indicates the discount rate which varies between a minimum of 0.04 and a maximum of 0.19 in order to test the relationship between the discount rate and the opinion of value. The third column indicates the rate of change for both the recovery recession Δ_{RR} and expansion contraction Δ_{EC} phases calculated based on the time series by using the data provided in Table 3 (arithmetic annual mean). The fourth column is the sinking fund factor a. The fifth column is the product between the rate of change and the sinking fund factor in the recovery recession phase of the market. The sixth column provides the determined cap rate of the recovery recession phase in the real estate market. The seventh column shows the product between the rate of change and the sinking fund factor in the expansion contraction phase, while the eighth column shows the determined cap rate in the expansion

contraction phase. Table 5 shows the same calculations but applied to the SEL. The second column Y indicates the discount rate which varies between a minimum of 0.04 and a maximum of 0.19. The third column indicates the rate of change for both the recovery recession Δ_{RR} and expansion contraction Δ_{EC} phases calculated based on the time series that considers the data provided in Table 3 (arithmetic annual mean). The fourth column is the sinking fund factor a. The fifth column is the product between the rate of change and the sinking fund factor in the recovery recession phase. The sixth column provides the determined cap rate in the recovery recession phase. The seventh column consists of the product between the rate of change and the sinking fund factor in the expansion contraction phase. Finally, the eighth column offers the determined cap rate in the expansion contraction phase.

Table 3 Annual Rate of Variation in Rent in Three Market Phases of the Real Estate Office Market in London

SL office market	1st phase	2nd phase	3rd phase
	Expansion Contraction	Recovery Recession	Expansion Contraction
	+	-	+
Mean (quarterly)	0.0186	-0.0092	0.0127
Stand. Dev (quaterly)	0.0135	0.0043	0.0090
Mean (annual)	0.0764	-0.0362	0.0517
SEL office market	1st phase	2nd phase	3rd phase
	Expansion Contraction	Recovery Recession	Expansion Contraction
	+	-	+
Mean (quarterly)	0.0191	-0.0124	0.0072
Stand. Dev (quaterly)	0.0104	0.0104	0.0057
Mean (annual)	0.0785	-0.0488	0.0289
SWL office market	1st phase	2nd phase	3rd phase
	Expansion Contraction	Recovery Recession	Expansion Contraction
	+	-	+
Mean (quarterly)	0.0175	-0.0002	0.0135
Stand. Dev (quaterly)	0.0122	0.0070	0.0072
Mean (annual)	0.0719	-0.0008	0.0553
C office market	1st phase	2nd phase	3rd phase
	Expansion Contraction	Recovery Recession	Expansion Contraction
	+	-	+
Mean (quarterly)	0.0236	-0.0282	0.0176
Stand. Dev (quaterly)	0.0206	0.0230	0.0258
Mean (annual)	0.0978	-0.1080	0.0723

Note: suburban London (SL); southeast London (SEL); southwest London (SWL); and City of London (C).

Table 4 Calculations of Different Cap Rates for Each Phase of the Office Market (Suburban London)

Y	Δ RR	Sinking Fund Factor a	Δ a_{RR}	R_{RR}	Δ a_{EC}	R_{EC}
0.04	-0.0362	0.2355	-0.0085	0.0485	0.0151	0.0249
0.05	Δ EC	0.2320	-0.0084	0.0584	0.0149	0.0351
0.06	0.0641	0.2286	-0.0083	0.0683	0.0146	0.0454
0.07	t (years)	0.2252	-0.0082	0.0782	0.0144	0.0556
0.08	4	0.2219	-0.008	0.088	0.0142	0.0658
0.09		0.2187	-0.0079	0.0979	0.0140	0.076
0.1		0.2155	-0.0078	0.1078	0.0138	0.0862
0.11		0.2123	-0.0077	0.1177	0.0136	0.0964
0.12		0.2092	-0.0076	0.1276	0.0134	0.1066
0.13		0.2062	-0.0075	0.1375	0.0132	0.1168
0.14		0.2032	-0.0074	0.1474	0.0130	0.127
0.15		0.2003	-0.0073	0.1573	0.0128	0.1372
0.16		0.1974	-0.0072	0.1672	0.0126	0.1474
0.17		0.1945	-0.0071	0.1771	0.0125	0.1575
0.18		0.1917	-0.0069	0.1869	0.0123	0.1677
0.19		0.1890	-0.0069	0.1969	0.0121	0.1779

Note: Data provided by CB Richard Ellis London. Author's elaboration.

Table 5 Calculation of Different Cap Rates for Each Phase of the Office Market SEL

Y	Δ RR	Sinking Fund Factor a	Δ a_{RR}	R_{RR}	Δ a_{EC}	R_{EC}
0.04	-0.0488	0.2355	-0.0115	0.0515	0.0126	0.0274
0.05	Δ EC	0.2320	-0.0113	0.0613	0.0125	0.0375
0.06	0.0537	0.2286	-0.0112	0.0712	0.0123	0.0477
0.07	t (years)	0.2252	-0.0110	0.0810	0.0121	0.0579
0.08	4	0.2219	-0.0108	0.0908	0.0119	0.0681
0.09		0.2187	-0.0107	0.1007	0.0117	0.0783
0.1		0.2155	-0.0105	0.1105	0.0116	0.0884
0.11		0.2123	-0.0104	0.1204	0.0114	0.0986
0.12		0.2092	-0.0102	0.1302	0.0112	0.1088
0.13		0.2062	-0.0101	0.1401	0.0111	0.1189
0.14		0.2032	-0.0099	0.1499	0.0109	0.1291
0.15		0.2003	-0.0098	0.1598	0.0108	0.1392
0.16		0.1974	-0.0096	0.1696	0.0106	0.1494
0.17		0.1945	-0.0095	0.1795	0.0104	0.1596
0.18		0.1917	-0.0094	0.1894	0.0103	0.1697
0.19		0.1890	-0.0092	0.1992	0.0101	0.1799

Note: Data provided by CB Richard Ellis London. Author's elaboration.

Table 6 shows the same calculations but applied to SWL. The second column *Y* of Table 6 indicates the discount rate which varies between a minimum of 0.04 and a maximum of 0.19. The third column indicates the rate of change for both the recovery recession Δ_{RR} and expansion contraction Δ_{EC} phases calculated based on the time series that considers the data provided in Table 3 (arithmetic annual mean). The fourth column is the sinking fund factor a. The fifth column is the product between the rate of change and the sinking fund factor in the recovery recession phase. The sixth column shows the determined cap rate in the recovery recession phase. In the seventh column, there is the product between the rate of change and the sinking fund factor in the expansion contraction phase. Finally, the eighth column shows the determined cap rate in the expansion contraction phase. Table 7 deals with the City of London (CL), which shows the largest variations in the rate of change in rent compared to the other urban areas of London considered in this article.

Table 6 Calculation of Different Cap Rates for Each Phase of the Office Market SWL

Y	ΔRR	Sinking Fund Factor a	Δa_{RR}	R_{RR}	Δa_{EC}	R_{EC}
0.04	-0.0008	0.2355	-0.0002	0.0402	0.0150	0.0250
0.05	ΔEC	0.2320	-0.0002	0.0502	0.0148	0.0352
0.06	0.0636	0.2286	-0.0002	0.0602	0.0145	0.0455
0.07	t (years)	0.2252	-0.0002	0.0702	0.0143	0.0557
0.08	4	0.2219	-0.0002	0.0802	0.0141	0.0659
0.09		0.2187	-0.0002	0.0902	0.0139	0.0761
0.1		0.2155	-0.0002	0.1002	0.0137	0.0863
0.11		0.2123	-0.0002	0.1102	0.0135	0.0965
0.12		0.2092	-0.0002	0.1202	0.0133	0.1067
0.13		0.2062	-0.0002	0.1302	0.0131	0.1169
0.14		0.2032	-0.0002	0.1402	0.0129	0.1271
0.15		0.2003	-0.0002	0.1502	0.0127	0.1373
0.16		0.1974	-0.0002	0.1602	0.0126	0.1474
0.17		0.1945	-0.0002	0.1702	0.0124	0.1576
0.18		0.1917	-0.0001	0.1801	0.0122	0.1678
0.19		0.1890	-0.0001	0.1901	0.0120	0.1780

***Note*:** Data provided by CB Richard Ellis London. Author's elaboration.

The second column Y of Table 7 indicates the discount rate which varies between 0.04 and 0.19. The third column indicates the rate of change for both the recovery recession Δ_{RR} and expansion contraction Δ_{EC} phases calculated based on the time series that considers the data provided in Table 3 (arithmetic annual mean). The fourth column is the sinking fund factor a. The fifth column is the product between the rate of change and the sinking fund factor in the recovery recession phase. The sixth column shows the determined cap rate in the recovery recession phase. The seventh column is the product between the

rate of change and the sinking fund factor in the expansion contraction phase. Finally, the eighth column shows the determined cap rate in the expansion contraction phase. After determining the two overall cap rates, it is possible to define the values by applying the cyclical capitalization model; see Equation 9. In the case of CL, it is possible to calculate the opinion of value in Table 8 by using the cap rates in Table 7.

Table 7 Calculation of Different Cap Rate for Each Phase of the Office Market C

Y	ΔRR	Sinking Fund Factor a	Δa_{RR}	R_{RR}	Δa_{EC}	R_{EC}
0.04	-0.1080	0.2355	-0.0254	0.0654	0.0200	0.0200
0.05	ΔEC	0.2320	-0.0250	0.0750	0.0197	0.0303
0.06	0.0850	0.2286	-0.0247	0.0847	0.0194	0.0406
0.07	t (years)	0.2252	-0.0243	0.0943	0.0192	0.0508
0.08	4	0.2219	-0.0240	0.1040	0.0189	0.0611
0.09		0.2187	-0.0236	0.1136	0.0186	0.0714
0.1		0.2155	-0.0233	0.1233	0.0183	0.0817
0.11		0.2123	-0.0229	0.1329	0.0181	0.0919
0.12		0.2092	-0.0226	0.1426	0.0178	0.1022
0.13		0.2062	-0.0223	0.1523	0.0175	0.1125
0.14		0.2032	-0.0219	0.1619	0.0173	0.1227
0.15		0.2003	-0.0216	0.1716	0.0170	0.1330
0.16		0.1974	-0.0213	0.1813	0.0168	0.1432
0.17		0.1945	-0.0210	0.1910	0.0165	0.1535
0.18		0.1917	-0.0207	0.2007	0.0163	0.1637
0.19		0.1890	-0.0204	0.2104	0.0161	0.1739

Note: Data provided by CB Richard Ellis London. Author's elaboration.

The second column of Table 8 is the discount rate that varies from 0.04 to 0.19. In the third and fourth columns are the cap rate of recovery recession and expansion contraction phases. They are also indicated in Table 7 in the sixth and eight columns. It is easily observed how the opinion of value based on cyclical capitalization is always in the middle between the two capitalizations based on the g factors of the recovery recession and expansion contraction phases. They are reported in the seventh and eighth columns of Table 8. Therefore, the result of cyclical capitalization seems to be less sensitive to the upturns and downturns of the property market. In Table 9, the same situation found in the SWL can be observed. As in Table 8, it is possible to observe that the opinion of value, based on cyclical capitalization, is normally included in the interval between the highest value obtained by direct capitalization by using the cap rate derived from the expansion contraction phase, and the lowest value obtained by direct capitalization based on the cap rate in the recovery recession phase.

Table 8 Opinion of Value Based on Cyclical Capitalization Using Data of Office Market C

AREA C VALUE DETERMINATION								
Y	Rrr	Rec	t	V - CC	V-RR	V-EC	Rate of Change RR	Rate of Change EC
0.04	0.0654	0.0200	4	31.0000	15.2846	50.0640	1.0487	0.5988
0.05	0.0750	0.0303		22.2214	13.3245	33.0358	0.6677	0.4867
0.06	0.0847	0.0406		17.4865	11.8090	24.6542	0.4808	0.4099
0.07	0.0943	0.0508		15.0000	11.0000	19.6668	0.3700	0.3540
0.08	0.1040	0.0611		12.4744	9.6191	16.3590	0.2968	0.3114
0.09	0.1136	0.0714		10.9594	8.8021	14.0046	0.2451	0.2779
0.1	0.1233	0.0817		9.7890	8.1127	12.2433	0.2066	0.2507
0.11	0.1329	0.0919		8.8547	7.5231	10.8762	0.1770	0.2283
0.12	0.1426	0.1022		8.0898	7.0131	9.7841	0.1535	0.2094
0.13	0.1523	0.1125		7.4511	6.5676	8.8916	0.1345	0.1933
0.14	0.1619	0.1227		6.9091	6.1751	8.1486	0.1189	0.1794
0.15	0.1716	0.1330		6.4429	5.8268	7.5205	0.1057	0.1673
0.16	0.1813	0.1432		6.0374	5.5154	6.9825	0.0946	0.1565
0.17	0.1910	0.1535		5.6812	5.2355	6.5165	0.0851	0.1470
0.18	0.2007	0.1637		5.3658	4.9825	6.1089	0.0769	0.1385
0.19	0.2104	0.1739		5.0844	4.7527	5.7495	0.0698	0.1308

Note: Data provided by CB Richard Ellis London. Author's elaboration.

Table 9 Opinion of Value Based on Cyclical Capitalization by Using Data of Office Market SWL.

AREA SWL VALUE DETERMINATION								
Y	Rrr	Rec	t	V - CC	V-RR	V-EC	Rate of Change RR	Rate of Change EC
0.04	0.0402	0.0250	4	31.8335	24.8854	39.9617	0.2792	0.2553
0.05	0.0502	0.0352		23.7395	19.9277	28.3727	0.1913	0.1952
0.06	0.0602	0.0455		18.9946	16.6172	21.9961	0.1431	0.1580
0.07	0.0702	0.0557		15.8558	14.2499	17.9609	0.1127	0.1328
0.08	0.0802	0.0659		13.6187	12.4729	15.1775	0.0919	0.1145
0.09	0.0902	0.0761		11.9408	11.0900	13.1417	0.0767	0.1006
0.1	0.1002	0.0863		10.6344	9.9832	11.5879	0.0652	0.0897
0.11	0.1102	0.0965		9.5878	9.0772	10.3630	0.0563	0.0808
0.12	0.1202	0.1067		8.7302	8.3220	9.3726	0.0491	0.0736
0.13	0.1302	0.1169		8.0145	7.6828	8.5553	0.0432	0.0675
0.14	0.1402	0.1271		7.4079	7.1348	7.8692	0.0383	0.0623
0.15	0.1502	0.1373		6.8873	6.6597	7.2852	0.0342	0.0578
0.16	0.1602	0.1474		6.4354	6.2440	6.7821	0.0307	0.0539
0.17	0.1702	0.1576		6.0396	5.8771	6.3440	0.0276	0.0504
0.18	0.1801	0.1678		5.6899	5.5509	5.9593	0.0250	0.0473
0.19	0.1901	0.1780		5.3787	5.2591	5.6186	0.0227	0.0446

Note: Data provided by CB Richard Ellis London. Author's elaboration.

The variation in valuation between the results from the application of cyclical capitalization and direct capitalization by using the cap rate of each property market phase changes, increases with a lower capitalization rate and tends to decrease with the highest overall cap rate. The rate of changes are indicated in the ninth and tenth columns of Table 9. Similar details are provided in Table 10 which deals with the application of cyclical capitalization to SEL.

The opinion of value based on the cyclical capitalization is always in between the values provided by the valuation based on the conventional DD model. The rate of change (valuation variation) is greater for the highest value property that is appraised with low overall capitalization rates. The results are also confirmed in Table 11 which concern the fourth area of SL.

The second column of Table 10 shows the discount rate which varies from 0.04 to 0.19. The third and fourth columns are the overall capitalization rates in the two phases. The fifth column is the temporal length of the market phases. The sixth column shows the opinion of value based on cyclical capitalization and the seventh and eighth columns, the final result with the opinion of value adopting direct capitalization with two different cap rates in the recession recovery (-) and the expansion contraction (+) phases. The last two columns indicate the valuation variations among the results. Figure 3 shows the relationship between value and discount rate in cyclical capitalization which considers a constant growth factor. It is possible to observe how the relationship is the same as that with the conventional DD model.

Figure 3 Relationship between Value and Discount Rate by Applying Cyclical Capitalization to Four Areas of London Office Market

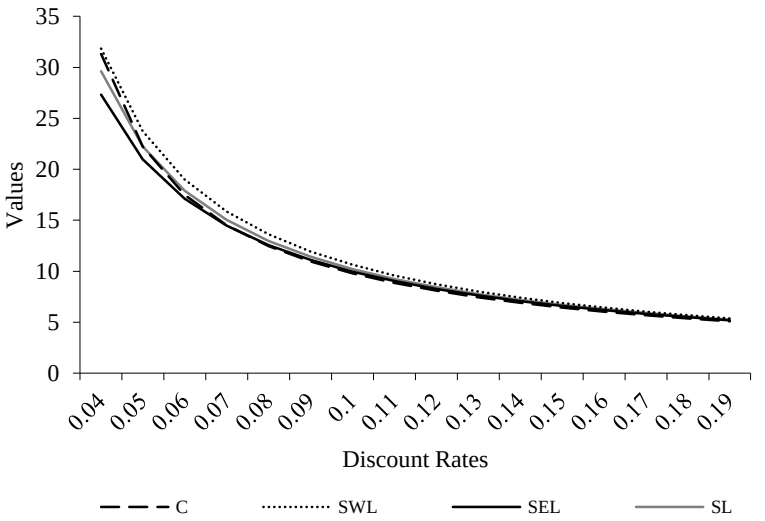


Table 10 Opinion of Value Based on Cyclical Capitalization by Using Data of Office Market SEL

AREA SEL VALUE DETERMINATION								
Y	Rrr	Rec	t	V - CC	V-RR	V-EC	Rate of Change RR	Rate of Change EC
0.04	0.0515	0.0274	4	27.3151	19.4168	36.5551	0.4068	0.3383
0.05	0.0613	0.0375		20.9680	16.3047	26.6363	0.2860	0.2703
0.06	0.0712	0.0477		17.1020	14.0519	20.9528	0.2171	0.2252
0.07	0.0810	0.0579		14.4762	12.3456	17.2691	0.1726	0.1929
0.08	0.0908	0.0681		12.5671	11.0085	14.6876	0.1416	0.1687
0.09	0.1007	0.0783		11.1124	9.9324	12.7781	0.1188	0.1499
0.1	0.1105	0.0884		9.9652	9.0478	11.3083	0.1014	0.1348
0.11	0.1204	0.0986		9.0362	8.3077	10.1420	0.0877	0.1224
0.12	0.1302	0.1088		8.2679	7.6793	9.1941	0.0766	0.1120
0.13	0.1401	0.1189		7.6217	7.1392	8.4084	0.0676	0.1032
0.14	0.1499	0.1291		7.0704	6.6700	7.7466	0.0600	0.0956
0.15	0.1598	0.1392		6.5943	6.2586	7.1815	0.0536	0.0890
0.16	0.1696	0.1494		6.1789	5.8948	6.6933	0.0482	0.0833
0.17	0.1795	0.1596		5.8133	5.5710	6.2674	0.0435	0.0781
0.18	0.1894	0.1697		5.4890	5.2808	5.8926	0.0394	0.0735
0.19	0.1992	0.1799		5.1993	5.0193	5.5601	0.0359	0.0694

Note: Data provided by CB Richard Ellis London. Author's elaboration.

Table 11 Opinion of Value Based on Cyclical Capitalization by Using Data of Office Market SL

AREA SL VALUE DETERMINATION								
Y	Rrr	Rec	t	V - CC	V-RR	V-EC	Rate of Change RR	Rate of Change EC
0.04	0.0485	0.0249	4	29.6073	20.6035	40.1405	0.4370	0.3558
0.05	0.0584	0.0351		22.2394	17.1205	28.4614	0.2990	0.2798
0.06	0.0683	0.0454		17.9170	14.6444	22.0485	0.2235	0.2306
0.07	0.0782	0.0556		15.0447	12.7937	17.9953	0.1759	0.1961
0.08	0.0880	0.0658		12.9864	11.3580	15.2018	0.1434	0.1706
0.09	0.0979	0.0760		11.4342	10.2118	13.1596	0.1197	0.1509
0.1	0.1078	0.0862		10.2195	9.2756	11.6016	0.1018	0.1352
0.11	0.1177	0.0964		9.2420	8.4965	10.3738	0.0877	0.1225
0.12	0.1276	0.1066		8.4377	7.8380	9.3813	0.0765	0.1118
0.13	0.1375	0.1168		7.7639	7.2741	8.5624	0.0673	0.1029
0.14	0.1474	0.1270		7.1910	6.7859	7.8752	0.0597	0.0952
0.15	0.1573	0.1372		6.6977	6.3589	7.2903	0.0533	0.0885
0.16	0.1672	0.1474		6.2685	5.9825	6.7864	0.0478	0.0826
0.17	0.1771	0.1575		5.8915	5.6481	6.3477	0.0431	0.0774
0.18	0.1869	0.1677		5.5578	5.3490	5.9625	0.0390	0.0728
0.19	0.1969	0.1779		5.2602	5.0800	5.6214	0.0355	0.0659

Note: Data provided by CB Richard Ellis London. Author's elaboration

The importance of using a valuation model cannot be underestimated. One reason for valuation uncertainty is due to the selection of the model. In fact, it has been stressed in the International Valuation Standards Council Valuation Uncertainty, TIP 4, para 27 that " *…for many asset types, more than one method or model may be commonly used to estimate the value…therefore the selection of the most appropriate method may itself be a source of valuation uncertainty…*" (International Valuation Standards Council, 2013). This makes clear the importance of proposing alternative valuation models that may be helpful for interpreting the basis of value.

5. Final Remarkets and Future Directions of Research

The work proposes an empirical application for a new family of income oriented methodologies called cyclical capitalization.

Cyclical capitalization models may be particularly useful in the valuation process of income producing properties affected by relatively frequent upturns and downturns of the market cycle. Further applications of these models may also be relevant for determining exit value in a DCF analysis. This article applies cyclical capitalization to four areas in the London office market based on the Inwood premise. It is possible to apply more than one discount rate according to the Hoskold premise. It is possible for a direct estimation of the g factor based on expertise in the recovery recession and expansion contraction phases if time series is not available. Furthermore, the application here is to freehold properties , therefore, calculations have been made by referring to observations of the two phases. On the other hand, the valuation of leasehold income producing properties may consider the temporal length of contractual rent instead of the length of the phases of the property market. In other studies, vacancy has been used in these models (d'Amato, 2017a; d'Amato, 2017b). Cyclical capitalization may also be applied to determine the scrap value. Its main assumption is that market rent and property price variation may be comparable to those of the past.

A future research direction could be determining the property market cycle and the relative a_{RR} and a_{EC} by using market expectations instead of time series analysis. Including the property market cycle in the valuation process may have countercyclical effects which would methodologically refute the boom bust problem of property market cycles. In this case, the application of cyclical capitalization may be useful especially in determining mortgage lending. Future types of cyclical capitalization modelling could address irregular property market cycles (Renigier-Bilozor et al., 2014, d'Amato, 2003) and this is a future challenge for this kind of property valuation modelling.

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