

# A CENTURY OF RESEARCH ON PROPERTY CYCLES - A LITERATURE REVIEW AND ANNOTATED BIBLIOGRAPHY

Arvydas Jadevicius<sup>1</sup>, Brian Sloan<sup>2</sup> and Andrew Brown<sup>3</sup>

*School of Engineering and the Built Environment, Edinburgh Napier University, Edinburgh EH10 5DT, UK*

The existence of cycles in the general business sector, as well as in building and property has grown to have significant importance in the UK, whereas the UK property market has been characterised by boom and bust cycles with a negative impact on the overall British economy. As a result, property cycles became a popular research topic amongst property professionals and scholars, with a greater understanding of the cyclical behaviour of the property market being seen as a major guide to the financial success (or failure) of property investments. Consequently, considerable literature has accumulated over the years on the subject. This paper provides a review of this literature with an annotated bibliography. The literature reviewed was mostly written in the UK and US, and includes contributions from both academics and professionals. This paper reviews research on the subject chronologically over one hundred year period. The particular emphasis is on the research methods, data and data analysis techniques employed, and the outcomes of the studies. The objectives are to provide a guide to the literature on property cycles, put more clarity on the subject as well as help to navigate anyone interested on property cycles throughout a considerable amount of research.

Keywords: Cycle, Literature Review, Property, Research, UK.

*"The farther backward you can look, the farther forward you are likely to see"*

Winston Churchill

## INTRODUCTION

The nature, development, and reasons behind property cycles have been researched for a number of years (Hakfoort, 1992; RICS, 1993). According to Rottke and Wernecke (2002, p.3) *"in the US research on property cycles began as early as the 1930s...The number of publications rose rapidly at the beginning of the 1980s...Up to now in the US and the UK, cycle research papers have increased enormously both in terms of quantity and quality"*. As Barras (2009) observed, the situation changed particularly after the Great Depression when academics and professionals became determined to find ways to prevent the recurrence of such dramatic events in the future. Therefore, they began to focus their attention on investment and building, as the most volatile element of the aggregate economic activity.

As a result, a considerable literature has accumulated over the years on the subject. This paper provides a review of this literature with an annotated bibliography. The reviewed literature was mostly written in the UK and US, and includes contributions from both academics and professionals. This paper reviews research on the subject chronologically over one hundred year period. The particular emphasis is on the research methods, data and data analysis techniques employed, and the outcomes of the studies. The objectives are to provide a guide to the literature on property cycles, to put more clarity on the subject as well as help to navigate anyone interested on property cycles through a considerable amount of research.

As indicated above, the paper considers research mostly performed in the UK and the US. For a detailed and robust discussion on the subject in the US, it is recommended to refer to two seminal papers of Pyhrr *et.al.* (1999) and Phyrr *et.al.* (2003). In the first paper, Pyhrr *et.al.* (1999) presented relevant research (mostly conducted by US researchers) and commentary on the subject in a micro-decision-making context. There the authors reviewed microeconomic and macroeconomic as well as practitioner publications on property cycles, discussed basic

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<sup>1</sup> a.jadevicius@napier.ac.uk

<sup>2</sup> b.sloan@napier.ac.uk

<sup>3</sup> a.brown3@napier.ac.uk

theory of cycles, their nature and dynamics, types, modelling, and their strategic implications for property market participants. In the second study, Phyrri *et al.* (2003) developed a real estate cycles research framework and classification model of the literature on the subject. Subsequently, they presented an alphabetic list of the publications related to property cycles which were published since 1980s primarily in the US. As it is seen, the list comprises more than 150 related publications.

Following Clemen's (1989) suggestions, the current review is not designed to be a critical review of the subject, but rather a catalogue containing major papers on the subject. The difficulty is in determining which publications should be included and which should not. The selection criterion was the importance of the paper as well as its citation record. Therefore, only major publications, which are primarily related to property cycles, and which contributed to a better understanding of the subject are discussed.

The paper is organised as follows. The next section reviews the early studies on the subject which emerged in the early twentieth century, following the section on the property cycles literature of the post-war period. The subsequent section discusses the modern literature on the subject. The fourth section outlines the post 1990s property crash studies. The concluding remarks summarise the discussion and present key findings.

## **EXPLORING STUDIES ON THE SUBJECT**

### **Early Studies**

The first serious discussions and analyses of building cycles emerged during the late nineteenth and early twentieth century. As Gottlieb (1976) and recently Barras (2009) indicate, German scholars were pioneers of building cycle research. The major subject of their investigations was the urban growth of German cities and its impact on residential construction, property market activity, and land values. Residential construction and associated real estate activities were seen as being particularly prone to wave-like movements. In his general work, Mangoldt (1907) demonstrated the tendency for urban growth to run in long waves in the city of Freiberg, Germany. Reich (1912, cited in Barras, 2009) investigated the building of Berlin between 1840 and 1910. Eychmüller (1915) studied the economic development, urban land and building policies of the city of Ulm between 1850 and 1919. Eisenlohr (1921) in his study discussed urban and housing conditions of the city of Mannheim. These studies were subsequently followed by the researchers from other metropolitan areas.

It is considered that in the US research on the subject started in 1933 with Hoyt's publication. In his book Hoyt attempted to demonstrate the cyclical fluctuations of Chicago property market. The reason for this analysis was the notion that the knowledge of the past movements of property is an indispensable part of any property investment. Results of the statistical analysis suggested that business conditions, commodity price level, the value of money, and particularly rapid increases in population, within short periods of time, were major causes for real estate cycles to occur. On the basis of his research, Hoyt identified relatively long and uncertain building cycles of an average of 18 years. These observations added to Wenzlick's (1933) findings, who identified similar cycles for St. Louise, and Maverick's (1933) observations, who found identical real estate fluctuations for Los Angeles and San Francisco.

In the aftermath of the Great Depression, Newman (1935) further investigated the importance of the subject. The building industry was chosen due to its size and importance to the US economy, and the number of people employed. His research was based on the building activity index, which was comprised from the dollar value of the building permits. The outstanding characteristic of this research was identification of so called "*major cycles*", lasting between 15 and 21 years. This coincided with the findings of other contemporary

researchers, including Hoyt (1933), Maverick (1933), and Wenzlick (1933). The other major finding of the paper was an existing correlation between building space and population. This fundamental relationship was not only reasonable but also statistically demonstrated.

A significant contribution towards the research and understanding of building cycles was made by the American economist Clarence D. Long, Jr. In 1936, Long published a study on the building industry of Manhattan in which he identified two types of cycles, i.e. major cycles or "*secondary secular movements*" of a period between 15 to 20 years, and minor around 4 years cycles (*ibid.*, p.184). After this study on a local building market, Long (1939) published an article on national building activity. This study comprised both residential and non-residential building indices of the US for the period between 1856 and 1935. The value-index included 27 and the number-index included 29 of the most populous cities of the country. Subsequently, Long identified 18-19 years building cycles of both building types.

A year later, Long (1940) published a second major study on the subject, after Hoyt's Chicago case study. As in his previous publications (Long, 1936; 1939), Long (1940) emphasised the building industry because of its size (the nation's largest single industry with its strategic importance to the US economy) and the severity of its fluctuations (swings were seen as the widest of any important industry). For his analysis, Long constructed the monthly index of building for the period between 1868 and 1940, which was based on the local figures of building permits. The results of the statistical analysis led the author to identify short building cycles of an average of 4 years duration, and long cycles of around 20 years. These findings were substantiated statistically and cross referenced with other investigations into the subject: Rigglemann (1934, cited in Long, 1940) identified 13-22 years long building cycles; Newman (1935) - 15-21 years; and Warren and Pearson (1937, cited in Robinson, 1938) - 18 years. However, the major weakness of Long's (*ibid.*) study was the neglect of the local factors of the building industry. As Singer (1942) indicated, Long (1940) dedicated a major part of his study to the theoretical discussion of "*inducement to invest*" in building and its correlation with the general economic concepts, such as interest rate, expectations, building costs, while paying less attention on migration or local property market differences, which could add more to a better understanding on the subject.

An interesting approach was adopted by Walter Isard. He researched the correlation between building cycles and transport innovations. In his first paper, Isard (1942a) constructed the theoretical framework of a one-way causal relationship between two sectors based on historical and statistical data analyses. It led the researcher to identify six cycles of building and transport development, and thus to conclude that "*the six building cycles which the United States has experienced from the late 1820's to the early 1930's can be accounted for by various innovations in transport*" (*ibid.*, p.112). In his second paper on the subject, Isard (1942b) investigated movements in transport-building cycles and their existence in strategic economic series, such as investment, population, production, and prices. The analysis clearly demonstrated the existence of highly regular and synchronous transport-building cycles, averaging 17 to 18 years. Consequently, this study led to the construction of the theoretical framework of the one-way causal relationship between building cycles and transport development.

In the UK one of the first studies on building cycles was made by Cairncross (1934). In his analysis of the Glasgow building industry for a period from 1870 to 1914, the author identified building cycles of around 20 years in length. Cairncross stated, housing will "*naturally fluctuate with the number and incomes of potential tenants*" (*ibid.*, p.4). Similarly, Wenzlick (1933) noted that the marriage-rate and migration had a substantial effect on building cycles.

With regard to the research on the subject in the United Kingdom, the same year as Cairncross (1934) published his investigation into Glasgow building industry, Shannon (1934) produced a building index (index of brick production) for England for the period between 1785 and 1849. Statistical analysis of the data led the author to identify the existence of 16 year long building cycles, which were closely correlated with population growth.

In 1937, Bowley made an investigation into fluctuations of the house-building and trade cycles between 1924 and 1936 for England and Wales. The analysis led to the conclusion that changes in the population was the primary factor influencing the demand for housing. According to Bowley, "*there has been little causal connection between the trade cycle and the house-building activity since the War*" (*ibid.*, p.181). The similar conclusions were drawn earlier by Beveridge (1930, cited in Bowley, 1937).

A more robust discussion on the subject was presented by Bowen (1940). In his analysis, Bowen employed three national time series Building Plans Passed, Ministry of Health Returns of Houses Completed, and Ministry of Labour Insured Unemployment Returns for the Building Industry for 1924-1938 period. After he eliminated the population factor, which was considered as the causal element for a long-term demand for building, and applied M. Abram's London and Cambridge Economic Service index, the connection between building activity and general trade cycle has been proved.

### **Three key post-war studies: Abramowitz (1964), Lewis (1965) and Gottlieb (1976)**

After a flourish of studies and publications on building cycles during the 1930's, there was a decline in the volume of research on the subject during the post-war period. As Lewis (1960) and Barras (2009) note, individual studies such as Grebler (1954), Weber (1955, cited in: Lewis, 1960), or Cairncross and Weber (1956) were published, which resumed the major studies of the 1930's only by adding newer data or expanding statistics of their predecessors.

One of the first attempts to renew the discussion on the subject was Lewis' (1960) empirical study on the dynamics of regional building. According to Lewis, regional building cycles were seen as major elements of the total building cycle mechanism. As he has observed, "*there can be no national building boom without there being at least one local boom, and the justification for a local boom must lie in local need*" (*ibid.*, p.533).

Lewis (1961) discussed the effect of aggregation onto movements through time of different variables. He theorised that aggregation can reverse the duration of lag. Therefore, this aggregation effect was seen as highly important for building.

Lewis (1964) attempted to explain the inverse long cycle of the Atlantic economy. The study was designed to identify the major factors of these long swings between two countries - the UK and the US. The results of the mathematical modelling indicated that housing, population, and, as the author indicated, "*times of good credit*" were causal agents of the long cycles (*ibid.*, p.118). It led the commentator to conclude that favourable conditions for one country were unfavourable to the other.

The inverse cycles were also studied by Cooney (1960), Guttentag (1961), Saul (1962), Vipond (1969) and other researchers. Cooney (1960) statistically demonstrated the inverse correlation of building activity of around twenty years of length in the UK and the US during the nineteenth century. Saul (1962) studied house building of England for a period between 1890 and 1914. He collected statistics on house building from over 100 sources. Statistical data analysis led him to conclude that, although the external factors identified by Cooney (1960) were of significant importance, the investment in housing "*was largely determined by causes special to the domestic housing market*" (*ibid.*, p.120). Guttentag (1961) in his study into the US residential construction during the 1946-1959 period demonstrated an inverse cycle between residential construction and business cycle. In contrast, Vipond's (1969, p.209)

investigation into fluctuations in private house-building in the UK for a period from 1950 to 1966 led to the conclusion that “*private residential building activity exhibited market pro-cyclical tendencies*” over the study period.

As Barras (2009) indicated, three major empirical studies - one by Lewis (1965) in the UK, and two by Abramowitz (1964) and Gottlieb (1976) in the US set the culmination of the post-war wave of research on building cycles.

In 1965, Lewis published his major historic survey of British economic growth from 1700 to 1950. Identification of the building cycles of 18 to 20 years of length was one of the central findings of the book. Lewis argued that building cycles were generated by a number of factors, such as production, income, population structure, migration, credit supply, and rent level, their interconnection as well as upon the economic context in which they occur. The impact of exogenous factors, such as war and the level of harvest were also noted. However, two key factors population and credit conditions were particularly emphasised. The importance of credit conditions was also addressed by Fleming (1966). As Fleming observed, “*a building boom will only take place if abundant funds are available to finance it*” (*ibid.*, p.436).

Following a tradition that originated from the National Bureau of Economic Research (NBER), Abramowitz (1964) published one of the major post-war studies on the subject in the US. His analysis of 38 annual time-series identified long waves in the aggregative construction of duration between 15 and 25 years. Uniform long swings were also found in the other major areas of American development, such as population growth, immigration, volume of import, and the railroad. These findings were referred to the earlier publications of Rigglemann (1934) and Long (1940). For his data analysis, Abramowitz first smoothed data series by computing their averages. Then he compared them with the original data. This enabled the researcher to identify long waves within all sectors of construction activity, as well as distinguish them from business cycle fluctuations, and check their correlation with other segments of the economy.

The study by Gottlieb (1976) offered probably the most comprehensive empirical analysis of the subject at that time. Gottlieb employed over 200 long time-series on building, finances, demographic and real estate activities of the US, UK, Sweden, France, Australia, Netherlands, Germany, Canada, Italy, and Japan. He then applied the mildest of smoothing procedures used by NBER, i.e. fixed reference-cycle methodology, in order to eliminate the influence of short cyclical fluctuations from the time-series. This procedure enabled him to isolate the long-swing movements and identify their specific turning points. The results of this study showed that both long local and national building cycles were virtually of the same duration, i.e. of around 20 years. As Gottlieb argued, “*local cycles were simply a local phase of a national movement, while the national movement was in turn mainly a coalescence of local cycles*” (*ibid.*, p.9). His analysis also identified the existing correlation between building cycles and demographic changes. As Gottlieb explained, favourable economic conditions encourage or discourage formation of new households, what consequently has a direct effect on the volume of demand for existing and additional dwellings.

### **Modern Studies**

In this section studies of the last forty years on the property cycles are considered. According to Solomou (1998) and RICS (1999), the 1960s was a period of apparent economic stability. Consequently, it led some commentators, including Abramowitz (1968) and Bronfenbrenner (1969), to question whether cycles were still relevant. However, the crash of the mid 1970s triggered a renewed wave of research on property cycles. In the UK this coincided with the launch of the Investment Property Databank (IPD) Long Run Index running from 1971, which provides reliable property data (RICS, 1994; Baum, 2002). As Barras (1994) indicated, his

personal interest on the subject was first prompted by the 1970s property crash, which led to the publication of several papers including Barras (1983; 1984; and 1987), as well as series of papers commissioned from the Economic and Social Research Council (ESRC) on building cycles in Britain (Barras and Ferguson, 1985; 1987a; 1987b).

Barras (1983, p.1) proposed “*a simple theoretical model of the office development cycle*” for Britain. He employed an accelerator type model (second-order difference equation) and, by incorporating the long term production period between building order and its completion, explained how cycles are generated around their equilibrium growth path.

Barras (1984) examined the major characteristics of the London office market. He discussed main factors which governed the growth of London as an international office centre, illustrated the apparently cyclical nature of office development in London, and briefly reviewed development control policies. Finally, he assessed the 1980s development cycle and likely impact of the future development of both office-based activities and information technologies on user demand for London offices in the post 1980s development cycle.

In 1987, Barras made investigation into “*urban development cycles*” in Britain, and their correlation with technological changes. First, he identified that long swings of 20-30 years are generated by shorter cycles, i.e. two shorter cycles are generally superimposed by the dominant long swing, causing pronounced building cycles. Building activity was identified as being more prone to cyclical fluctuations than any other investments. Subsequently, he examined the possible trajectory of the British urban development cycle in relation to technological changes, particularity of IT and micro-electronic. Finally, the author assessed “*the likely characteristics and timing of the next wave of urban development in the UK*” (*ibid.*, p.24).

A significant analysis and discussion on the subject was presented by R. Barras and D. Ferguson in their three stage research commissioned from the ESRC. In the first paper, Barras and Ferguson (1985) investigated the detailed chronology of five major building sectors including private industrial, private commercial, private housing, public housing, and other public building. The research was conducted using two sets of time-series: (i) post-war data of new orders of construction and its output in each of five building sectors, which was available from 1957 (annually) and 1958 (quarterly); (ii) and fixed capital formation of building industry from 1856. The authors employed spectral analysis to determine and compare each building series, their cyclical characteristics, and relationships between the cycles, as well as informal turning point analysis to identify the precise chronology of each cycle.

Notwithstanding limitations of both methodologies, Barras and Ferguson demonstrated that the UK post-war building experienced “*strong cycles*”, i.e. “*short cycles*” of 4 - 5 years, “*major cycles*” of 7 - 9 years, and “*long swings*” of 28 years within housing and 19 years long cycles within other building. Short cycles were highly linked to general business cycles, major cycles – to production lags within construction industry and public expenditures, and long swings – to “*major wave of urban development*” (*ibid.*, p.1389). In a second paper, Barras and Ferguson (1987a) developed a theoretical dynamic model “*suitable for dynamic modelling of these cycles*” (*ibid.*, p. 353). The framework of the model incorporated both endogenous (production lag within the industry) and exogenous conditions (variations in economic activity) of the cycles. The theoretical dynamic model was based on Box and Jenkins (1976) approach to modelling ARIMA (autoregressive moving average) processes. The researchers also included an error-correction technique to derive short-run adjustment dynamics and long-run equilibrium relationships between time-series. In the concluding paper Barras and Ferguson (1987b) presented empirical results of their research - the best possible time-series model for each property type (private sector industrial, commercial and residential). The authors also noted that user activity is an exogenous factor which heavily

impacts commercial property. The construction lag, which serves as an endogenous cycle mechanism, was identified as being responsible for a major cycle of a period of 35 quarters.

In the US modern studies continued to be influenced by the NBER. Grebler and Burns (1982) researched short-term post-war cycles in major US construction sectors following established NBER methodology. The data for the study covered the period from 1950 to 1978. This empirical analysis of duration, amplitude and number of cycles led authors to identify six cycles in private residential construction (18 quarters in average), four in private non-residential (29 quarters in average), and four cycles in state and local construction (28 quarters in average) as well as relative difference in average amplitude of cycles.

As the literature suggests, the US cycle research in the 1980s paid particular attention to the office market. According to Wheaton (1987), Clapp (1993) and Barras (2009), it was because of a greater expansion of the US office market at that time, and due to high volatility of this market. Wheaton (1987) presented one of the key studies. In this research, Wheaton looked at the post-war US office market and revealed recurrent ten years cycles. Wheaton analysed data between 1960 and 1986 of national office employment, building starts and completions, absorption, and vacancy rate. He also compared historic office vacancy rates of ten major US cities and their averages. These results clearly suggested the existence of a “*national office market cycle*” (*ibid.*, p.283).

The dynamics of office markets in the US was further investigated by DiPasquale and Wheaton (1992). In their article, DiPasquale and Wheaton developed a universal equilibrium model of real estate space (rent) and real estate asset (capital). For their research the authors used comparative statistical analysis of a number of macroeconomic indicators, including short-term and long-term interest rates, availability of construction finances, production level, and employment. The developed four-quadrant diagram was able to illustrate important connections within the property sector and between its two markets (space and asset).

Clapp (1993) adopted the equilibrium model proposed by DiPasquale and Wheaton (1992) for his research. Clapp explored two possible models for measuring natural (normal) vacancy rate, which were also used for office market forecasting.

### **Post 1990s property crash studies**

The 1990s property crash, which is considered as far greater than that of the 1970s, led to a renewed discussion on property cycles (Barras, 1994; RICS, 1994). As Barras (2005, p.63) observed, after this crash the same two questions were asked: “*why did it go wrong?*” and “*how can we avoid it happening again?*”. Property professionals and scholars blamed inaccurate data, its analysis and interpretation, and anticipated that things will improve next time (RICS, 1994; Barras, 2005). Consequently, it prompted a number of important publications on the subject, including Barras (1994), RICS (1994; 1999), Grenadier (1995), McGough and Tsolacos (1995a), and Renaud (1995).

The seminal study commissioned by the RICS (1994) looked into fundamentals of the property cycles and investigated both endogenous and exogenous forces that have produced them. Commentators employed post-war economic and property data of Britain for a period between 1962 and 1992. They used a data set on all property total returns compiled by the IPD, and other major indices, such as rental growth, yield movements, construction orders, and property investment. The visual and statistical data analysis identified short 4-5 years “*recurrent but irregular fluctuations in the rate of total return*” (*ibid.*, p.27). Short cycles were also visible within other sectors and areas of British economy. Other findings suggested close timing between economic and property cycles. The development cycle was identified as a subset of the property market which gives most of its idiosyncratic features to the property cycle.

In their second study, RICS (1999) extended the period of the research back to 1921. The visual data analysis confirmed the existence of recurrent, but irregular property cycles. Spectral analysis showed evidence of cycles ranging from 4 to 12 years. The average length of the cycles was 8 years. As the authors indicated, some fuller statistical tests suggested the existence of major cycles of 9 years of duration, and minor cycles of 5 years duration. The analysis of property returns suggested existence of three separate epochs, i.e. interwar period between 1920s and 1930s, which was characterised as being highly volatile but with particularly high returns on property, post-war period through the 1950s and 1960s, which exhibited less volatile property fluctuations, and highly volatile post 1970s period.

The aim of Barras' (1994) paper was to re-examine the conceptual model of the building cycle proposed in his earlier paper (Barras, 1983), and identify whether this model could explain the 1990s property crash. To implement his goal, Barras employed various time series, including GDP, commercial development, bank lending, new building orders, rents, institutional investments, yield, and capital values of a period from 1952 to 1992. He also identified major forces which generated these cycles. Accordingly, Barras demonstrated that both the 1970s and 1980s property cycles "*were triggered by the same particular combination of conditions in the real economy, the money economy and the property market*" (*ibid.*, 195). Moreover, it has also been demonstrated that "*different cyclical forces are at work in the occupier market, the development industry and the investment market, sometimes opposing and sometimes reinforcing each other*" (*ibid.*, p.195). Therefore, as Barras stated, a better knowledge of the interaction of these underlying forces leads to a greater understanding of the property cycle.

McGough and Tsolacos (1995) identified forces generating UK property development cycles. The methodology they used was adopted from the business cycle modelling. In their statistical analysis the commentators examined various property demand and economic variables for a period between 1980 Q1 and 1994 Q4 quarterly. The raw data was filtered using the Hodrick-Prescott technique. Subsequently, the researchers estimated the major statistical properties of the chosen variables (amplitude, persistence, procyclicality, and countercyclicality). Amplitude was measured by the standard deviation, persistence - by first order autocorrelation, and both procyclicality and countercyclicality - by cross-correlation. The findings indicated existing correlation between property and certain economic indicators. Establishment of "*stylized facts*" was the other major finding.

In the US, a significant discussion on the subject was presented by Grenadier (1995), where the author investigated underlying causes of prolonged real estate cycles. He also attempted to identify why some types of property are more prone to wave-like movements than others. Accordingly, Grenadier developed a leasing and construction model to explain the recurrence of over-building and stickiness of vacancy rates.

A considerable amount of literature on property cycles was published from the late 1990s. As Barras (2004) observed, in both the late 1980s and late 1990s property cycles were truly global phenomena, which affected most markets internationally. As a result, property scholars attempted to research cycles as an international phenomenon, as well as their links with capital markets. According to Barras (2009, p.71) "*the inevitable result was the launch of a new and more extensive phase of research on real estate cycles during the 1990s*". An international phenomenon of the property cycles was discussed by Renaud (1995), Pyhrr *et al.* (1999), Dehesh and Pugh (2000), Pugh and Dehesh (2001), and other researchers. Herring and Wachter (1998), ECB (2000), Davis and Zhu (2004), and Lizieri (2009) were amongst others who investigated links between property cycles and capital markets.

Renaud (1995) investigated the global property cycle for the period between 1985 and 1994, and identified three international and four major domestic factors which generated this cycle.

This exploratory survey was based on quantitative data analysis of most of OECD and several NIE countries.

Dehesh and Pugh (2000, p.1) examined post Bretton-Woods *“Property Cycles in the Global Economy”*. The research covered the post-1980s period with a particular emphasis on Asian countries, especially Japan. As the authors have identified, the breakdown of the Bretton-Woods system has placed property in a wider context. As a result, property became an international business, thus under the sway of both its endogenous forces and conditions within the international economy.

In a successive paper on the subject, Pugh and Dehesh (2001) investigated post-1980s property cycles, the role of institutional conditions, and the international interdependence between property and finance. In this comparative evaluative review the authors identified that economic adversities seep into the socio-economic level of the national economies and thus have an impact on finance and property sectors both locally and internationally.

The internalisation of property markets and global transmission of cyclical instability since the 1990s triggered property professionals and scholars to investigate apparent links between property and financial markets (Barras, 2009). The correlations between property cycles and capital markets were analysed by Quigley (1999), ECB (2000), Davis and Zhu (2004), Lizieri (2009), and other researchers. Some of empirical studies on the subject focused particularly on residential property. As Davis and Zhu (2004) observed, this was because of the data available for this type of research. Country-specific studies identified an obvious correlation between housing and the economy. Empirical analysis by de Greef and de Haas (2000) demonstrated a relationship between Dutch housing and the mortgage market. In the US, Quigley (1999) studied housing prices and economic conditions. Gerlach and Peng (2003) revealed the existence of a long-run dynamic relationship between house prices and bank lending in Hong Kong.

In their seminal work Fergus and Goodman (1994, p.1) assembled and assessed *“a broad range of evidence about the degree to which a “credit crunch” decreased real estate lending and construction activity in the 1989-92 period”*. Consequently in their empirical historical analysis the authors proposed a chronology of the *“credit crunch”*. Davis and Zhu (2004) looked at the interconnection between the commercial property market and bank lending from the macroeconomic perspective. For their research, Davis and Zhu catalogued annual data for 17 countries for the period between 1985 and 1995 collected by BIS (Bank for International Settlements). They then developed a reduced-form single equation model based on the work of Wheaton (1999) to assess the relationship between banking and commercial property. Cross-country empirical analysis fully demonstrated this correlation. These findings matched the ones proposed by Fergus and Goodman (1994) a decade earlier.

## **Summary**

In reviewing the literature it was found that property cycles have been recorded throughout history (Hakfoort, 1992; Barras, 2009). However, serious discussions and analyses on the subject emerged only during the early twentieth century. German scholars including Mangoldt (1907) and Eisenlohr (1921) were pioneers of building cycle research. In the US research on the subject started in 1933 with Hoyt’s publication on the Chicago real estate cycles. Cairncross (1934) published one of the first studies on UK building cycles. Since then the relevance of the subject has attracted greater attention of scholars, who investigated different aspects of the subject. In the UK, Lewis (1965) published historic survey of British economic growth from 1700 to 1950, Barras (1987) published an extensive study of post-war building, RICS (1994; 1999) examined the main elements of the UK property cycles. Subsequently, as Barras (2009) indicated, research into property cycles began to be conducted in private sector consultancies rather than in academia with the purpose of commercial forecasting.

As results of the literature review indicated, the pioneering studies on the subject were particularly concerned with fluctuations in building (especially in residential), which was identified as the largest and probably the most volatile component of aggregate investment. These studies were highly inclined into statistical data analysis and its interpretation, as there was an obvious lack of robust and consistent data. Consequently, early researchers identified both short (around 5 years) and long (around 20 years) building cycles. The prime explanation for the existence of these cycles was a relationship between population growth and the state of the economy. Moreover, building cycles were seen as local phenomena, independent from fluctuations in business.

Early modern property cycle studies in the UK were based on the premise that major property cycles are generated by their endogenous forces, while minor cycles were seen as the demand-side phenomenon, which is reacting to changes in the economy. The key factor for cycles to occur was an inherent production lag of construction industry. Particular attention was also on the financial side of the phenomena. As Barras (2009) indicated, favourable financial conditions fuelled two speculative property booms, one in the early 1970s, another in the late 1980s, which brought the British economy into recession. According to Baum (2002), a growing property portfolio within financial institutions was also identified as a catalyst for the property cycles in that period. In the US, however, researchers were focused on rent adjustment processes within the property market, rather than on construction lags. As it was noted, American researchers considered exogenous impulses from the wider economy as having greater impact on property cycles. Due to considerable greater elasticity of the supply side of the property market than its demand, developers were prone to over- or under-shoot the market equilibrium, thus creating a deficit or surplus of property. Therefore, in order to anticipate the future property market behaviour, sophisticated rent adjustment models were created.

The experience of the 1990s brought new perspectives into property cycles research. These studies underlined a need for a global perspective on property cycles and particularly their correlation with capital markets. As Herring and Watcher (1999), Davis and Zhu (2004) and Barras (2009) observed, ever closer integration of property and financial markets mean that instability in one market can be easily transmitted to another local or national market. Financial engineering and international flows of capital connect both markets. Moreover, an increasing internalisation of the property market and the same macroeconomic environment translate cycles between countries. Consequently, this contagion effect is creating a greater volatility within markets.

## **CONCLUSIONS**

The aim of this paper was to provide a chronological literature review on property cycles over a one hundred year period mostly written in the UK and US. As it was noted above, the particular emphasis was on research methods, data and data analysis techniques employed, and outcomes of these studies. The paper was not designed to be a critical review, but rather a catalogue of the studies on the subject. Consequently, it was aimed to provide a guide to the literature on property cycles, put more clarity on the subject as well as help to navigate anyone interested on property cycles throughout a considerable amount of research chronologically. The annotated bibliography presents major publications, what data and statistical techniques were employed by researchers, and what were the outcomes of these studies.

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Research period	Publication	Data employed	Statistical technique	Outcomes of the Study
Early studies	Hoyt, H. (1933) <i>One hundred years of land values in Chicago. The relationship of the growth of Chicago to the rise in its land values, 1830-1933.</i> The University of Chicago, US, pp.452	Land values; New construction; Lots subdivided; Public improvements; Population; Foreclosures; Real estate transfers; Bank clearings; Canal-rail stock prices; Wholesale commodity prices	Data comparison; Turning point analysis; Time-series analysis (1830-1933); Visual data analysis (of maximum and minimum)	18 years building cycles; Real estate cycles may be a passing phase
	Cairncross, A.K. (1934) <i>The Glasgow Building Industry (1870-1914). The Review of Economic Studies</i> , Vol.2, No.1, pp.1-17	House building and demolition; Rents; Site values; Heavy industry activity; Interest rates; Population (rate of marriage and immigration)	Data comparison; Turning point analysis; Time-series analysis (1870-1914); Visual data analysis (of maximum and minimum)	20 years building cycles; Real estate cycles have a great correlation with population
	Newman, W.H. (1935) <i>The building industry and business cycles.</i> University of Chicago Press, Chicago, pp.72	Building permits; Building costs; Population growth; Bond yields; Rents; Operating expenses; B.B.N index	Time-series analysis (1875-1933); Turning point analysis; Correlation analysis; Index composition	15-21 years "major cycles"; 4-5 years "minor cycles"; Building cycles precede business cycles; Independence between movements of two series; Constant correlation between building space and population
	Long, C.D., Jr. (1940) <i>Building Cycles and the Theory of Investment.</i> Princeton University Press, NJ, pp.239	Gross capital formation; Total construction; Building costs; Incomes; Interest rates; Building levels; Population; Taxes; Housing costs	Time-series analysis (1868-1940); Turning point analysis; Simple mathematical calculations (averages, deviations, medians); Correlation analysis; Assumption testing; Index composition; Index smoothing (by means of the Macaulay 43-term graduation)	4 years short building cycles; 20 years long building cycles; Greater volatility of cycles in building than in business; Building cycles precede business cycles; Correlation between long building cycles and the general business conditions
	Bowen, I. (1940) <i>Building Output and the Trade Cycle (U.K. 1924-38). Oxford Economic Papers</i> , No.3, pp.110-130	Building plans passed; Returns of houses completed; Insured unemployment returns for the building industry; Savings	Time-series analysis (1924-1938); Correlation analysis; Data comparison; Visual data analysis; Data smoothing (3 year moving average); Trend analysis	Correlation between building an population; A greater role of building within the economy
Post-war studies	Abramowitz, M. (1964) <i>Evidences of Long Swings in Aggregate Construction since the Civil War.</i> National Bureau of Economic Research, New York, pp.252	38 series on non-farm residential, private non-residential, farm, public and ship building, and transportation and public utilities	Data comparison; Time-series analysis (1870-1955); Turning point analysis; Visual data analysis (of maximum and minimum, and peaks and troughs); Data smoothing (5 and 10 year moving average); Amplitude measurement	15-25 years building cycles; Close interaction between building and the economy; Structural change of the US economy leads to demise of cycles

Lewis, P. J. (1965) <i>Building Cycles and Britain's Growth</i> . Macmillan, London, pp.396.	20 time-series (import/export, building, marriage rate, bank rate, house prices, rents, etc.)	Time-series analysis (1700-1950); Turning point analysis; Correlation analysis; Index creation (artificial time-series); Probability modelling (experiments with multiplier-accelerator mechanism)	18-20 years building cycles; Correlation between building and population and credit; Building is a function of the local factors
Gottlieb, M. (1976) <i>Long Swings in Urban Development</i> . National Bureau of Economic Research, New York, pp.360	Around 200 long time-series (building, building costs, population, land values, etc.)	Time-series analysis (1840s-1930s); Comparison/Visual inspection; Smoothing (Time-series decomposition/Fixed term moving average); Turning point analysis; Correlation analysis; Data comparison; Visual data analysis (of maximum and minimum, and peaks and troughs); Amplitude measurement	20 years building cycles; Correlation between building and population, as well as local and national cycles
Barras, R. (1983) A simple theoretical model of the office development cycle. <i>Environment and Planning A</i> , Vol.15, No.10, pp.1381-1394	Time-series (new orders, capital values, construction costs, returns) Statistics (inflation, interest rates, GDP)	Time-series analysis (1956-1980); Mathematical modelling; Historical overview; Correlation/Regression analysis; Turning point analysis	Model of the office development cycle; Clarification of the mechanics behind the cycle; Three crucial parameters – the length of the delay between new investment orders and completions, the adjustment rate and the depreciation rate; National average cycle period – 8 – 10 years
Barras, R. (1987) Technical change and the urban development cycle. <i>Urban Studies</i> , Vol.24, No.1, pp.5-30	Time-series of 5 sectors – private industrial, commercial and house-building, and public house-building and other public building	Time-series analysis (1958-1983); Time-series modelling; Spectral analysis; Turning point analysis	20-30 years “urban development cycles”; Interconnection between 5 year, 10 year, and 20 year cycles; Suggestions for policy making
Barras, R. and Ferguson, D. (1985) A spectral analysis of building cycles in Britain. <i>Environment and Planning A</i> , Vol.17, No.10, pp.1369-1391	Time-series of 5 sectors – private industrial, commercial and house-building, and public house-building and other public building; Series of building and user activity, property prices, rents, yields, building costs, and capital values	Time-series analysis (1958-1985 for new orders of construction, and 1856-1985 for fixed capital formation and building); Spectral analysis; Turning point analysis; ARIMA process; Error-correction; “Trial and error testing”	UK post-war building experience “strong cycles”, i.e. 4-5/7-9/20 years; Industrial and commercial property correlates with user demand, residential – with investment activity; Construction lag – endogenous cycle mechanism; User activity - exogenous cycle mechanism
Barras, R. and Ferguson, D. (1987a) Dynamic modelling of the building cycle: 1. Theoretical framework. <i>Environment and Planning A</i> , Vol.19, No.3, pp.353-367			
Barras, R. and Ferguson, D. (1987b) Dynamic modelling of the building cycle: 2. Empirical results. <i>Environment and Planning A</i> , Vol.19, No.4, pp.493-520			

<p>Grebler, L. and Burns, L.S. (1982) Construction Cycles in the United States Since World War II. <i>Journal of American Real Estate and Urban Economics Association</i>, Vol.10, No.2, pp.123-151</p> <p>Wheaton, C.W. (1987) The cyclical behaviour of the national office market. <i>Journal of American Real Estate and Urban Economics Association</i>, Vol.15, No.4, pp.281-299</p> <p>DiPasquale, D. and Wheaton, W.C. (1992) The Markets for Real Estate Assets and Space: A Conceptual Framework. <i>Journal of the American Real Estate and Urban Economics Association</i>, Vol.20, No.2, pp.181-198</p>	<p>Total construction; GNP; Business investment</p> <p>Time-series (construction, completions, office employment, absorption, vacancy rate)</p> <p>Interest rates; Construction finances; Production level; Employment; GDP; Rents; Vacancy rates</p>	<p>Time-series analysis (1950-1978); Regression analysis; Turning point analysis</p> <p>Time-series analysis (1960-1986); Visual data analysis; Multi-equation modelling</p> <p>Comparative statistical analysis; Time-series analysis; Multi-equation modelling</p>	<p>Low interdependence between total construction and the economy; Un-effectiveness of public programmes; Various cycles (residential – 18Q, private non-residential – 29Q, state construction – 28Q)</p> <p>10 year office cycles; Growing cycle amplitude over time; 3 possible scenarios (forecasts from 1986 to 1992)</p>
<p>Barras, R. (1994) Property and the economic cycle: Building cycles revisited. <i>Journal of Property Research</i>, Vol.11, No.3, pp.183-197</p>	<p>GDP; Capital values; Yields; Investments; Bank lending; Rents; Commercial development</p>	<p>Accelerator type model (second-order difference equation); Time-series analysis (1952-1992); Turning point analysis</p>	<p>Property market is highly cyclical; Cycles are of different duration; They operate on the basis of demand and supply for building; Suggestions for policy making; Predictions for the next decade</p>
<p>RICS (1994) <i>Understanding the property cycle: Economic Cycles and Property Cycles</i>. The Royal Institution of Chartered Surveyors, London, pp.97</p>	<p>Property returns; Rents; Yield; Construction; Investment; GDP; Consumer spending; Manufacturing output; Employment; Interest and gilts rates; Inflation</p>	<p>Time-series analysis (1962-1992); Visual data analysis; Property performance measurement; Turning point analysis; Spectral analysis; Simple regression modelling; Model testing</p>	<p>4-5 years property cycles; Close timing with economic cycles; UK property market is cyclical; UK property cycles are the product of economy and its endogenous (particularly development lag) characteristics; Statistical analysis; Existence of property cycles</p>
<p>RICS (1999) <i>The UK Property Cycle - a History From 1991 to 1997</i>. The Royal Institution of Chartered Surveyors, London, pp.57</p>	<p>Property returns; Yield; Rents; Capital growth; GDP; Building investment; RPI, Gilts, Equities, Treasury bills</p>	<p>Time-series analysis (1921-1997); Turning point analysis; Visual data analysis; Correlation analysis; Time-series simulation; Time-series desmoothing; Filtering (HP technique); Spectral analysis; Multivariate time-series regression with variable additions/deletion; Long-run cointegration; Modelling - capital asset pricing mode (CAPM)</p>	<p>4-9 years cycles; Correlation with the economy; Strong cyclical pattern; Long-run analysis adds little to the ability to understand or predict the market</p>

McGough, T. and Tsolacos, S. (1995) Property cycles in the UK: an empirical investigation of the stylized facts. <i>Journal of Property Finance</i> , Vol.6, No.4, pp.45-62	GDP; Employment; Consumer expenditure; Industry output; Interest rates	Time-series analysis (1980-1994); Statistical analysis (amplitude – standard deviation, persistence – first order autocorrelation, procyclicality and countercyclicality – cross-correlation)	Tight correlation between GDP, manufacturing and business output and the office and industrial property; and between GDP, consumer expenditure and non-food retail sales and retail property; Establishment of stylized facts
Wheaton, C. W., Torto, R.G. and Evans, P. (1997) The Cyclic Behavior of the Greater London Office Market. <i>Journal of Real Estate Finance &amp; Economics</i> , Vol.15, No.1, pp.77-92	Absorption; Rent; New construction orders; Vacancy; Total and occupied stock; Interest rates; Office employment; Real construction costs	Time-series analysis (1970-1995); Structural econometric methodology – multi-equation adjustment model; Econometric outlook (scenario planning)	Employment can explain London office market movements; London office market is volatile; Commercial property in European cities is forecastable; Shocks (positive/negative) generates and “echo”
Barras, R. (2005) A Building Cycle Model for an Imperfect World. <i>Journal of Property Research</i> , Vol.22, No.2, pp.63-96	Take-up; Vacancy; Real rental growth; Building starts and completions	Time-series analysis (1970-2004); Multi-equation modelling (series of linear difference equations and set of second order linear difference equations); Building cycle simulation; Model testing	Property market is cyclical; Cyclical fluctuations are generated endogenously around and equilibrium growth path; The longer the construction lag, the longer the cycle period; 5 key parameters which determine model behaviour – the output growth rate; the depreciation rate; the construction lag; the combined transmission coefficient; the demand elasticity
Barras, R. (2009) <i>Building Cycles: Growth and Instability</i> (Real Estate Issues). Wiley-Blackwell, London, UK, pp.448	Output; Take-up; Building starts; Capital; Vacancy; Rents	Time-series analysis (1968-2006); Model simulation (series of difference equations); Model testing	6 key parameters which determine model behaviour – the size of initial displacement; the construction lag; the output growth rate; the rate of depreciation; the combined transmission coefficient; the demand elasticity; The greater the construction lag, the greater the period of the cycle