PROPERTY RESEARCH TRUST

IPF Research Programme

The implementation of long-term prudent valuation models across the UK and Mainland Europe for financial regulation purposes

A Research Report funded jointly by the Investment Property Forum Research Programme and the Property Research Trust

Neil Crosby
Professor Emeritus, University of Reading, UK
and
Aart Hordijk,
Professor Retired, Tilburg University, The Netherlands

The implementation of long-term prudent valuation models across the UK and Mainland Europe for financial regulation purposes

SUMMARY

The overall aim of the research is to assess the practicality of implementing a long-term prudent value model as an alternative to the market valuation model for use within UK and European Commercial Real Estate lending markets.

In 2017 the Bank for International Settlements Basel Committee, which provides guidance on financial regulation internationally, proposed a new definition or framework for property valuation called prudent value. Although the Basel Committee only produce guidance, many jurisdictions are committed to following it wherever possible, including the EU. But the European Commission is the first jurisdiction to declare its intention to adopt this new valuation framework within its Capital Requirements Regulations (CRR) and the implications for the EU countries of this proposal is now a major driver for research into the new definition and its implications. In November 2022, the UK Prudential Regulation Authority published proposed changes to its financial regulations, and they also included the new Basel Committee valuation framework as the valuation basis for lending purposes at loan origination and for monitoring purposes.

The objectives of the research are to:

- Identify methodologies for the development of long-term valuation models and make recommendations for a preferred methodology.
- Identify how that might be developed across individual countries within Europe and further develop previous findings on data requirements and availability.
- Examine whether a common harmonized approach across individual countries within Europe is feasible and whether it needs to be applied at an individual property or market segment level.
- Provide guidance to national professional valuer organisations on their role in supporting the development of a rational and deliverable long-term value methodology. This may vary significantly for different national professional valuer organisations.

Previous research (see, for example, Crosby and Hordijk, 2021 and IPF, 2020) concluded that the long-term prudent value model is a major departure from the normal day-to-day work of the valuer and that the valuation profession is not well-prepared for such a departure. There are a number of different models available to generate long-term values but there are various constraints to implementation. These include the availability of data to drive the models,

especially in less mature real estate markets, and the difficulty in identifying a long-term prudent value for an individual property.

The previous research recommends a combination of market value at the individual property level supplemented by a through-the-cycle long-term value to produce market adjustment factors at a property market segment level.

This research paper examines the practicality of these recommendations across the range of European real estate markets. It identifies the data necessary to run long-term modelling and the availability of that data across the different countries within Europe. It uses the disaggregated data of the UK to undertake a preliminary examination of whether it is desirable to disaggregate the data by geographical region, micro-location and property type.

The findings are that the gains from disaggregation are relatively minor as different segments of real estate markets tend to behave similarly through time and are highly correlated. But there some variation between the capital value changes of different segments and the scale of the movements can also be very different. However, it is still an encouraging preliminary finding as data availability in less mature markets tends to be sparse and aimed at the larger real estate market segments such as capital cities. In any long-term data modelling to determine market value adjustment factors, these primary markets will have to act as indicators of sub-markets within these countries, as highly disaggregated data does not exist at present in the majority of countries within Europe.

The overall message of this research and that of previous industry and academic research into long-term valuations can be combined into a number of recommendations for the regulators who are currently deciding on how to implement the Basel III framework. These are:

1. It is virtually impossible to construct a robust, consistent prudent valuation regime at the level of the individual property.
2. It is possible to develop a relatively harmonised prudent value regime based on market analysis at a market segment level. A consistent and evolving regime which accords with the Basel III prudent valuation framework guidance is deliverable across the EU and the UK.
3. The regime should be based on the provision of asset specific market valuations which take into account specific asset characteristics coupled with centrally managed market adjustment factors, which can be developed and updated periodically based on long-term analysis of real estate market cycles.
4. There are some major constraints to implementation, not least that the necessary property market data is mostly in private hands and, in most jurisdictions, is not collated systematically outside of the major cities.

National financial regulators and the professional institutions of the commercial real estate will need to operate in partnership to develop periodic market value adjustment factors across

those sub-markets which have the past data necessary to operationalize the models. As indicated above, the necessary real estate data is currently in private hands and not in the public domain, but this research has illustrated that, if the current private data held on real estate markets across Europe can be accessed, long-term prudent values can be used as an indicator to help prevent shocks to the financial system caused by cyclical real estate markets.

Authors

Neil Crosby, Professor Emeritus, University of Reading, UK

Aart Hordijk, Professor Retired, Tilburg University, The Netherlands

The research is funded jointly by the Investment Property Forum, under the auspices of the IPF Research Programme, and the Property Research Trust.

The IPF Research Programme is funded by a cross-section of businesses, representing key market participants. The IPF gratefully acknowledges these contributing organisations:

CBRE Investment Management, DWS, Government of Singapore Investment Corporation, Investment Property Forum, JLL, LaSalle Investment Management, Legal & General Investment Management, Life Science REIT, M&G Real Estate, MSCI, Nuveen Real Estate and Warehouse REIT.

The Property Research Trust, as a charity, has a remit of supporting, delivering and disseminating high quality, independent reliable knowledge, and future thinking through research funding. It is administered by a Board of Trustees, comprising senior academics and others with expertise in surveying, real estate and the built and natural environments. The Trust funds research globally.

Contents

ACKNOWLEDGEMENTS

The authors acknowledge the financial support of the Investment Property Forum and the Property Research Trust and the support of Sue Forster and Alan Dalgleish throughout the whole period of the research programme. Steven Devaney was a member of the research team before he moved from the University of Reading to CBRE and provided very important and well thought out content to both the application and the early part of the project dealing with literature and the existing modelling. He was an integral part of the team that undertook the long-term value modelling for the previous IPF funded research by the Universities of Cambridge and Reading, which provides the major academic stimulus for this paper. Wolfgang Kalberer provided detailed information on the workings of the European Parliament and Commission for which we are very grateful. We also acknowledge the contributions of MSCI, INREV and a number of the leading European real estate consultants who provided detailed information on their respective datasets across Europe and those who gave us valuable feedback on the first draft of this report.

The implementation of long-term prudent valuation models across the UK and Mainland Europe for financial regulation purposes

SECTION ONE - INTRODUCTION

This report relates to the role of Commercial Real Estate (CRE) within the financial stability agenda. Since the Global Financial Crisis, CRE has been a major component of initiatives to prevent global financial markets experiencing the turbulence caused by significant asset market downturns. A major focus of the debate surrounding the role of CRE has been the influence that property valuation has on the amount of lending secured on CRE.

The debate has centered on the inadequacies of existing valuation practices and how they might be improved and a number of initiatives from a range of stakeholders in the process have come together to frame the discussion. These include financial system advisors and regulators (for example, the Basel Committee for Banking Supervision (BCBS) of the Bank for International Settlements (BIS), the International Monetary Fund (IMF) and a number of central banks including the European Central Bank (ECB) and the Bank of England (BOE)), the self-regulating institutions of valuation practices (i.e. The International Valuation Standards Council (IVSC), The European Group of Valuers (TEGOVA) and RICS, and other real estate industry groups (For example, the Property Industry Alliance (PIA), Investment Property Forum (IPF), the Commercial Real Estate Finance Council Europe (CREFC Europe) and the Long-term Sustainable Value Network (L-TSV)) .

Europe has been the focus for this debate rather than, for example, the US. This is partly because of the volatility of some of the major CRE markets in Europe during the crisis, leading to an awareness of the critical role of CRE in that crisis (for example the UK and Ireland). The European Systematic Risk Board summarized this concern as *"Evidence shows that one of the main causes of past banking and financial crises has been credit-driven real estate "boom/bust" cycles"* (ESRB, 2022). It may also be partly because of a perception that residential real estate played a more significant role in the US, and partly because there were already alternative valuation regimes in place in some European jurisdictions that were perceived to have moderated the damage inflicted on financial systems during the GFC. Therefore, the valuation expertise in alternative valuation bases for secured bank lending resided in Europe.

Two events have cemented that focus. In 2017 the BIS Basel Committee, which provides guidance on financial regulation internationally, proposed a new definition or framework for property valuation called prudent value. Although the Basel Committee only produce guidance, many jurisdictions are committed to following it wherever possible, including the EU. But the European Commission is the first jurisdiction to declare its intention to adopt this new valuation framework within its Capital Requirements Regulations (CRR) and the implications for the EU

countries of this proposal is now a major driver for research into the new definition and its implications.

In November 2022, the UK Prudential Regulation Authority published proposed changes to its financial regulations, and they also included the new Basel Committee valuation framework as the valuation basis at loan origination and for monitoring purposes.

Europe is therefore leading in what is a wider global research agenda based around the determination of a "better" property valuation approach for secured lending purposes. There is an international academic literature on both CRE and the GFC, and the linkages between the two, but the first serious Government and industry commercial property market-based response developed initially in the UK where the central bank, academe and practice worked together to address the particular issues of trying to develop an alternative valuation regime for secured lending.

The UK forms a major case study market for research into CRE prudent value valuation methods. In addition to being the first jurisdiction to develop the long-term value discussions beyond the Mainland European long-standing basis of Mortgage Lending Value, it is classified as the most transparent market in the world by JLL (2022), has the longest-running set of consistent commercial property market data and, according to MSCI, is the largest institutional CRE investment market in Europe (See Table 5).

The UK response to the financial stability issues raised by the GFC officially commenced on 16 June 2010, when the UK Chancellor of the Exchequer announced the creation of the Independent Commission on Banking, chaired by Sir John Vickers. The Commission was asked to consider structural and related non-structural reforms to the UK banking sector to promote financial stability and competition, and to make recommendations to the Government by the end of September 2011. The Independent Commission on Banking released its Final Report on 12 September 2011 (ICB, 2011). (https://webarchive.nationalarchives.gov.uk/ukgwa/20120827143059/http://bankingcommission.independent.gov.uk///).

In seminars running up to its release in 2011, the chair had made comments similar to those of the ESRB in 2022, placing CRE at the centre of the problem with the financial system not being able to withstand the impact of a major property market downturn. In the UK, the three main CRE market indicators of property prices are published by MSCI (previously IPD), and the major international property consultants CBRE and JLL. All three All Property quarterly capital value indices agreed that the fall exceeded 40% between Q2 2007 and the bottom of the trough in Q2 2009.

Although the final report was silent on any CRE related changes, a major omission considering the comments about the role of CRE in creating the problem, the UK BoE started to take note of the importance of CRE within their financial stability strategy and engaged with the CRE

industry. Initially a group of interested industry individuals under the chairmanship of Nick Scarles (Grosvenor Estates) combined together into the Real Estate Finance Group to produce an influential discussion paper titled a Vision for Real Estate Finance (REFG and IPF, 2014) and placed property valuation reform as one of its seven major recommendations, alongside recommendations concerning property finance data capture. The property valuation recommendation was taken on by a working group chaired by Rupert Clarke which produced a preliminary report on long-term valuations (PIA/CREFC Europe/IPF, 2017). This sparked further research funded by the Investment Property Forum carried out by a team from the Universities of Cambridge and Reading (IPF, 2020).

This research programme developed and tested alternative property valuation models for secured lending valuation and these findings provide the focus for this study which is aimed at how these recommendations can be implemented across Europe. The UK research programme was closely observed by the UK central bank, who were developing their own models, drawing off these findings, and using them to both assess the health of financial lending within the CRE sector and to carry out stress testing of individual banks (see for example, references to CRE in the BoE Financial Stability Reports from December 2015 onwards (BoE, 2015)).

The overall aim of the research is to assess the practicality of implementing a long-term prudent value model as an alternative to the market valuation model for use within UK and European CRE lending markets. The implications of this research are wider than Europe as the Basel Committee valuation framework represents global guidance, and many national jurisdictions are committed to the Basel Accords. Europe also has a wide range of real estate markets, from some of the most mature markets in the world to some very immature, under-developed CRE markets, so any findings are relevant to the similar range of markets across the world.

The long-term value model developed within the UK research programme is a major departure from the normal day-to-day work of the valuer and latest contribution to the discussion by Crosby and Hordijk (2021) suggested that the valuation profession is not well-prepared for such a departure. There are a number of different models available to generate long-term values but Crosby and Hordijk (2021) identified various constraints. Not least of these is this wide range of developed and under-developed markets across Europe and more globally (JLL, 2022), which leads to a restricted range of available real estate data sources in the less developed markets. A second major consideration is the difficulty of determining a long-term prudent value for an individual property. Crosby and Hordijk (2021) identified some of the issues appertaining to this question and recommended a market segment-based solution.

The specific objectives of the research are to:

- Identify methodologies for the development of long-term valuation models and make recommendations for a preferred methodology.

- Identify how that might be developed across individual countries within Europe and further develop previous findings on data requirements and availability.
- Examine whether a common harmonized approach across individual countries within Europe is feasible and whether it needs to be applied at an individual property or market segment level.
- Provide guidance to national professional valuer organisations on their role in supporting the development of a rational and deliverable long-term value methodology. This may vary significantly for different national professional valuer organisations.

The next section of the paper reviews the existing academic and practitioner research, the proposed methodology to be tested and the regulatory context provided by the Basel Committee and the EU and UK PRA proposals.

SECTION TWO - A REVIEW OF EXISTING MODELS AND THEIR ALTERNATIVES WITHIN A REVISED REGULATORY REGIME.

There are a number of major issues within the existing literature. These include the issues appertaining to current practice, existing and alternative concepts of value, proposed changes to the regulatory regime and methods of valuation to reconcile the new regulatory regime with rational and logical methods, and the setting of research questions regarding practical application.

Crosby and Hordijk (2021) summarized this research, and their findings and conclusions form the basic framework for this paper. They found that:

1. Research by EMF-ECBC (2017) confirms that the normal property valuation basis used to value collateral assets across Europe is market value. Market value is defined as the estimated amount for which the property should exchange on the date of valuation between a willing buyer and a willing seller. It is an exchange price concept and holds no information as to how prices might change in the future, specifically over the term of the loan. But a small number of regimes do use a form of prudent valuation, defined as mortgage lending value within valuation standards and within EU regulations (RICS Europe, 2018).

2. Market value can act pro-cyclically due to the relationship between the price of assets and the amount that can be borrowed assuming no other no other lending constraints are applied in rising real estate markets. Behavioural research (Brunnermeier and Pedersen, 2009; Allen and Gale, 1999; Jensen and Meckling, 1976; Graff and Webb, 1997; Crosby and Hughes, 2011) suggests that bonus structures and the limited liability of lenders, fund managers, etc. incentivize market participants to surf the wave of any asset price boom, lengthening the boom period, increasing the volatility and the extent of the downturn and the subsequent dangers to the financial system.

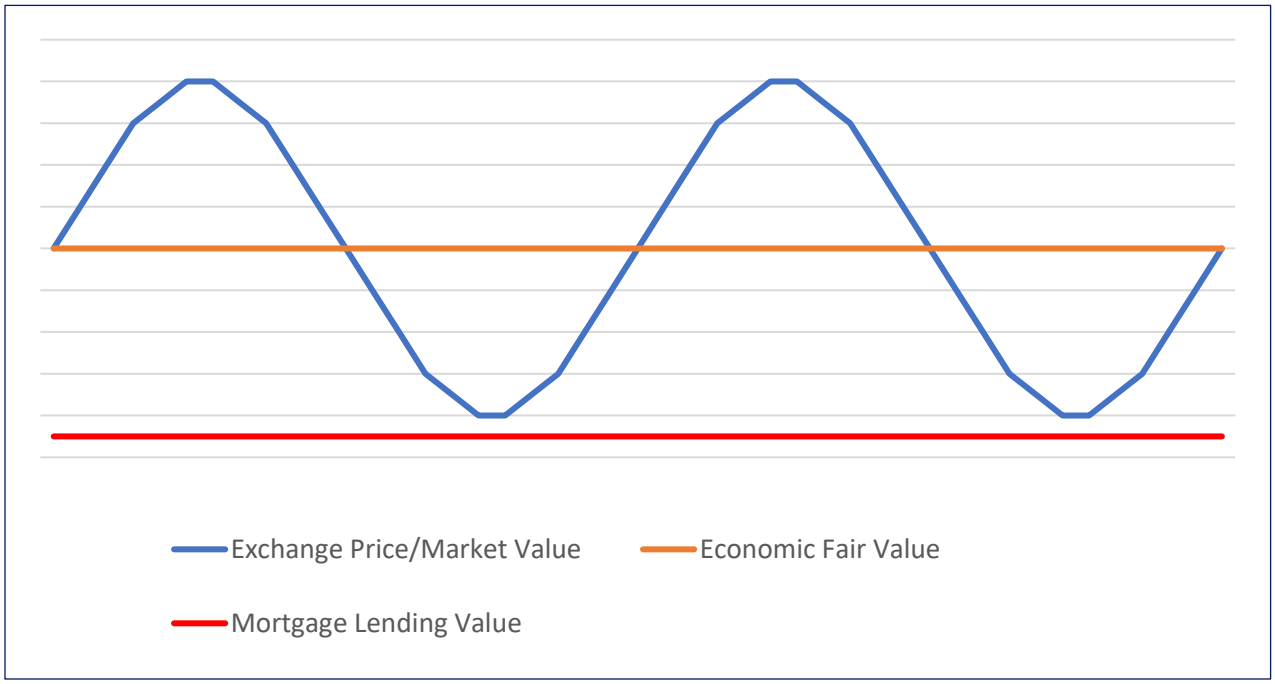
3. Research into real estate markets has identified two different types of historic bubble in real estate prices; those related to capital asset prices and those related to occupier markets (PIA/CREFC Europe/IPF, 2017). It suggests that both occupier markets and capital markets need separate consideration in any reform of the valuation approach

4. A number of global organizations and institutions identified in Section One have examined alternative long-term or prudent valuation concepts and bases. There are two different concepts of prudent value. The first is an under-the-cycle model that aims to identify a value that reflects no more than the lowest value of the real estate asset over the term of the loan and the second is a through-the-cycle model that aims to identify the fair economic or equilibrium value.

RICS Europe (2018) provides a simple illustration of the different concepts of under-the-cycle and through-the cycle. (Fig. 1). Very simplistically, an under-the-cycle model seeks to identify a value that is below any future value. There is an existing basis and definition of value, mortgage lending value, which is an under-the-cycle model. This definition of value is used already in a few countries in Europe and has seen most development in Germany and (for residential real estate) Spain (Crosby and Hordijk, 2021). Some commentators suggest the valuation has a shelf life through the term of the loan but it does have a date of valuation attached. PIA/CREFC Europe/IPF (2017) modelled mortgage lending value and found that it is not static and reacts to changes in market inputs through time, particularly market rent and capitalization rate.

A through-the-cycle model is one which aims to identify an equilibrium or economic fair value, and this can be higher or lower than market value or price in the future. It is an attempt to identify whether current market prices are above or below their logical, rational price. This kind of valuation has in the past been characterized as a calculation of worth, and the definition of investment value has some through-the-cycle characteristics. Investment value has not, to our knowledge, been formally applied in a secured lending valuation role.

Figure 1: A Stylised View of the Different Approaches to Prudent Value



Source RICS Europe (2018)

In 2017, The Basel Committee (BCBS, 2017) proposed a new framework or definition of value which they termed prudent value. The BCBS framework is:

> *"Value of the property: the valuation must be appraised independently using prudently conservative valuation criteria. To ensure that the value of the property is appraised in a prudently conservative manner, the valuation must exclude expectations of price increases and must be adjusted to take into account the potential for the current market price to be significantly above the value that would be sustainable over the life of the loan. National supervisors should provide guidance, setting out prudent valuation criteria where such guidance does not already exist under national law. If a market value can be determined, the valuation should not be higher than the market value…"*

The European Commission in 2021 proposed adoption of this new definition by incorporating it into proposals to change paragraph 229 of their Capital Requirements Regulations (CRR). At the time of writing this proposal (EC, 2021) has been considered by the European Parliament. On 24th January 2023, the Economic and Monetary Affairs Committee voted to finalise reforms of the banking rules and MEPs adopted the proposed changes set out in the revised CRR and Capital Requirements Directives (CRD) which includes the prudent value framework (https://www.europarl.europa.eu/news/en/press-room/20230123IPR68613/econ-committee-voted-to-finalise-reforms-of-banking-rules). The lead MEP commented *"The texts adopted today in the committee on Economic and Monetary Affairs send a message that, in spite of the*

inclusion of some EU specificities, the European Parliament is committed with [to] implementing the Basel III international agreements as close as possible into EU legislation."

In private correspondence with the authors, an experienced observer of EU affairs concerning real estate suggested that the final legal CRR text should be voted upon around the middle of 2023. The CRR is planned to come into force on January 1st 2025 across the whole EU and therefore there is a short window to detail the operation of prudent value and undertake any relevant training.

The UK PRA consultation, including the prudent valuation proposals, runs until the end of March 2023 and it is likely that the Prudent Valuation framework will also survive the UK consultation process and become part of the loan origination process. A harmonized understanding of the prudent value concept globally to conform with Basel III is a desirable objective.

The different long-term valuation approaches from both the academic and professional valuation literature and the testing of the various approaches are fully set out in the literature (PIA/CREFC Europe/IPF, 2017; IPF, 2020; Crosby, et al. 2021; Crosby and Hordijk, 2021). Crosby and Hordijk (2021) concluded:

a. A through-the-cycle concept should be adopted for the application of a prudent or long-term value. Mortgage lending value is an under-the -cycle concept that leads to prescriptive cook-book routines in the absence of an objective valuation "target" such as exchange price or the worth of a property to the investment market (a form of investment value). The only logical under-the-cycle model would be a set of periodic "future market value" assessments through the term of the loan.
b. Prudent value should be defined as the lower of through-the-cycle long-term value or market value, whichever is lower. This is reconcilable with the Basel III framework definition. A through-the-cycle model aims to identify the long-term equilibrium value given long-term economic circumstances and fits all of the criteria set out in the Basel III prudent value framework.
c. A conventional discounted cash flow approach is a form of through the cycle analysis, attempting to identify any price divergence from an economically rational fair value. It uses forecasts of rental growth. PIA/CREFC Europe/IPF (2017) tested this form of through-the-cycle model and found that forecasts of UK rental market growth undertaken in the late 1980s were not able to isolate an occupier/rental market cycle, as rental growth forecasts tend to over-estimate future growth when in a booming market and underestimate future rental value change when in a falling or weaker market. However, models based on cap rate observations did not isolate the UK 1990 occupier market crash either as they were not a factor in that downturn.

d. IPF (2020) found that the best performing models within the UK were those based on econometric analysis of long-term property market, economic and financial indicators, assessing both a long-term sustainable rent and a long-term capitalization rate, and using an adjusted market value approach to report any mis-match between long-term and market value.
e. There are less sophisticated alternatives. A basic past trend model using just property market data did isolate both the last two major crashes in the UK market with a two-year warning period (PIA/CREFC Europe/IPF. 2017; IPF, 2020).
f. The preferred long-term value prudent value model *is not a valuation model*. It is a market analysis model and therefore should be applied at a market level. There is research into the fact that different sub-sectors within national markets behave consistently and that highly aggregated indicators should be utilized to produce adjustment factors with the individual market valuation taking account of the asset specific characteristics. Prudent value should not be found at the individual property level.
g. This approach would require collaboration between the EU and national financial regulators and international and national CRE industry/valuer organisations to develop a modelling framework.
h. Finally, the EU goal of harmonization of *practices* across Europe is not currently possible due to the range of characteristics across EU CRE markets. It may be practical in the longer term, but harmonization of frameworks is a more obtainable short-term goal, leaving national jurisdictions to identify practices within the framework. Europe includes both mature, highly transparent countries (JLL, 2022) with well-established long-term data sets as well as immature CRE markets with little or no data sets on which to base some form of modelling (this finding is developed further in this research paper). It is also worth noting that there is a long-standing debate within European valuation concerning the interpretation of valuation bases, most notably market value. A comparison of MSCI valuation and transaction-based indices illustrates that some countries based on Germanic traditions seem to have far less valuation volatility than other Western European countries. Transaction based indices are more consistent, suggesting some valuations mark to market better than others.

SECTION THREE - THE RESEARCH OBJECTIVES

The objectives of the research are to:

- Identify methodologies for the development of long-term valuation models and make recommendations for a preferred methodology.
- Identify how that might be developed within the different countries across Europe and further develop previous findings on data requirements and availability.
- Examine whether a common harmonized approach across Europe is feasible and whether it needs to be applied at an individual property or market segment level.

- Provide guidance to national professional valuer organisations on their role in supporting the development of a rational and deliverable long-term value methodology. This may vary significantly for different national professional valuer organisations.

The above review of the literature and research carried out in the wake of the GFC indicates that a number of objectives can be satisfied from an analysis of those findings. It is clear that market value as a sole valuation basis for secured lending purposes is not sustainable into the future and the case for supporting information is undeniable. The CRE industry must respond; and is doing so (Crosby and Hordijk, 2021).

The conceptual framework and reconciliation of that framework with possible alternatives has been investigated and it is clear that a through-the cycle definition coupled to market value provides the preferred basis for prudent value and addresses each of the elements of the valuation framework. This is also the conclusion of the Bank of England, who rejected mortgage lending value when considering their response to the CRE valuation question within their own financial stability deliberations. Initially they adopted a through-the-cycle investment value approach based on the work of Crosby and Hughes (2011) (See BOE, 2015) while paying close attention to the IPF (2020) research developing alternative through-the-cycle models.

The actual wording of the European Commission and UK PRA proposals are as follows:

The EC – "Article 229 is amended as follows:

(a) the title is replaced by the following:

EN 129 EN 'Valuation principles for eligible collateral other than financial collateral

(b) paragraph 1 is replaced by the following:

'1. The valuation of immovable property shall meet all of the following requirements:

(a) the value shall be appraised independently from an institution's mortgage acquisition, loan processing and loan decision process by an independent valuer who possesses the necessary qualifications, ability and experience to execute a valuation;

(b) the value is appraised using prudently conservative valuation criteria which meet all of the following requirements:

(i) the value excludes expectations on price increases;

(ii) the value is adjusted to take into account the potential for the current market price to be significantly above the value that would be sustainable over the life of the loan;

(c) the value is not higher than a market value for the immovable property where such market value can be determined.

The value of the collateral shall reflect the results of the monitoring required under Article 208(3) and take account of any prior claims on the immovable property." (EC, 2021)[1]

The UK PRA - The LTV must be prudently calculated in accordance with the following requirements:

(a) the amount of the loan shall include the outstanding loan amount and any undrawn committed amount of the mortgage loan, without taking into account credit risk adjustments and other own funds reductions related to the exposure or any form of funded or unfunded credit protection, except for pledged deposits accounts with the lending institution that meet all requirements for on-balance sheet netting and that have been unconditionally and irrevocably pledged for the sole purposes of payment of the mortgage loan;

(b) the value of the property must be appraised by a suitably qualified valuer, who is independent from the institution's mortgage acquisition, loan processing and loan decision process, using prudently conservative valuation criteria. The valuation must:

(i) exclude expectations on price increases;
(ii) be adjusted to take into account the potential for the current market price to be significantly above the value that would be sustainable over the life of the loan; This is a draft Instrument to accompany CP16/22 'Implementation of the Basel 3.1 standards'.
(iii) where a market value can be determined, not be higher than the market value; and
(iv) where the mortgage loan is financing the purchase of the property, not be higher than the effective purchase price; and

c) the value of the property must not depend materially on the performance of the borrower.

Both broad valuation frameworks are identical even if some of the associated text differs, and the broad frameworks follow the Basel Guidance.

Through-the-cycle modelling must address the requirements that the valuation "*must be adjusted to take into account the potential for the current market price to be significantly above the value that would be sustainable over the life of the loan"*, must address the issue of "*expectations of price increases"* and, in conjunction with market value, the comparison with market price. In addition, there is UK PRA paragraph c) above to be considered.

There are two aspects to this issue. One of these is market cycles and the other is specific asset characteristics, and this includes the performance of the borrower.

[1] Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL amending Regulation (EU) No 575/2013 as regards requirements for credit risk, credit valuation adjustment risk, operational risk, market risk and the output floor. resource.html (europa.eu).

The framework includes a market value benchmark and in some cases prudent value can be market value. Where market value is materially affected by the risk of borrower default, it should be reflected in the market valuation. For example, a property owned and occupied by the borrower should be valued with vacant possession as it is the security for the loan. If the borrower defaults, the vacant building will be used to cover losses. If the building is let, tenant default may impact on the borrower. These risks should be fully considered in the pricing of the building. So, paragraph c) will be included in the assessment of market value.

However, as indicated above within the literature, the major risk to the financial system is tied to the cyclical behaviour of real estate markets, not the performance of individual loans. So through-the-cycle must address the main component of the framework which is the risk that the current market price could fall during the loan period. That requires analysis of where we are in the cycle at any particular point in time, for example at loan origination, and how that will affect price levels into the future. *This is market analysis, not valuation.*

In addressing the financial regulation proposals of the EU and the UK PRA relating to commercial real estate, there is another aspect which is outside the scope of this paper but is very relevant to the overall picture. Commercial real estate lending is subject to risk weighting rules which rely to a great extent on loan-to-value ratios, especially within the "standardized approach".

Paragraph 3.159 in Chapter 3 of the PRA consultation paper[2] notes that the use of "*prudently conservative valuation criteria*" is "*important to help ensure that the valuation of the collateral securing the loan is prudent given the proposed key role of LTV to calculate the SA risk weight for real estate exposures*".

The "value" concept or definition used in bank lending is therefore central to the risk weightings that should be applied to real estate. A change in the valuation regime will impact on the risk weightings applied to different real estate financial portfolios. It should be noted that if risk weightings are increased in combination with a valuation regime that is changed to reduce the risk of real estate defaults, there is a danger of double counting the measures to reduce the risk of real estate. In seeking to reduce the possibility of a repeat of the Global Financial Crisis in 2007-2009, the combined measures may go too far. This could have negative impacts on the efficiency of the financial system.

The next section addresses the main research questions which circulate around the central question of whether we can develop through-the-cycle models within different markets in Europe. This raises the data requirements and data availability issues which are addressed in the next section.

[2] https://www.bankofengland.co.uk/prudential-regulation/publication/2022/november/implementation-of-the-basel-3-1-standards

SECTION FOUR - THROUGH-THE-CYCLE PRUDENT VALUATIONS – ALTERNATIVE METHODS.

There are a number of different methods that satisfy the through-the-cycle conceptual approach and this section sets out the alternatives and the minimum data requirements for each.

Investment Value

PIA/CREFC Europe/IPF (2017) examined the three valuation methods defined in valuation standards which are market value, mortgage lending value and investment value. Market value and mortgage lending value are not through-the-cycle models.

The investment value definition set out in IVS and RICS valuation standards is:

"the value of an asset to the owner or a prospective owner for individual investment or operational objectives".

This definition is fairly recent and Crosby and Hughes, (2011) suggested that the previous definition of investment value was a better definition and could be interpreted as a market orientated concept rather than grounded in the objectives of the individual investor. The original definition was:

"*The worth or value of a property to a particular investor or class of investor for identified investment objectives"*

The recent amendment makes the current definition of investment value less appropriate as the original concept suggests that differences between market value and a through-the-cycle model are not solely referenced to the individual buyers and sellers but have some element of irrational pricing by the market as a whole ("*class of investors"*).

The main aim of investment value is to identify over and under-priced markets and assets, which qualifies it firmly within the conceptual through-the-cycle model camp.

At the most basic level, this model requires four major inputs;

- Rental growth forecasts
- Exit value
- Discount Rate (risk free rate plus risk premium)
- Holding period

Forthcoming RICS guidance on the application of discounted cash flow modelling will set out the intricacies and difficulties of applying this model at the individual property level but Crosby and Hughes (2011) illustrated a simple analysis of the UK office, retail and industrial market segments which was adopted by the BOE in 2015. This analysis was based upon a five-year holding period; industry consensus forecasts of rental growth of the main sectors of the UK CRE market; a discount rate based on a risk-free rate of return from long-term Government bond redemption yields plus a fixed risk premium sourced from a market survey; and an exit value calculated from the rental growth rate and an exit capitalisation rate extracted from a 15-year rolling average of past rates.

This model identified the impending UK market downturn in 2007 at least two years before it happened. However, the limitations of this approach were revealed by further analysis of this model in PIA/CREFC Europe/IPF (2017) as it failed to identify the previous downturn in 1990. It is heavily dependent upon the accuracy of the rental value forecasts and these forecasts failed to identify the 1990 rental market downturn. This model can be operated at both individual property and market index levels but, at the individual property level, is a highly technical exercise with significant inputs and therefore will increase the delivery cost of individual property asset valuations.

Adjusted Market Value

In addition to the examination of the valuation bases set out in valuation standards, PIA/CREFC Europe/IPF (2017) also examined an industry practice model based purely on past trends. This model was an analysis of the performance of CRE markets as indicated by proprietary performance measurement series such as MSCI, CBRE and JLL. It is derived by comparing the current market value as reflected in the capital value index, to a long-term trend line. The regression-generated long-term trend line is drawn dynamically (recalculated every time the index is produced) through an inflation-adjusted capital value index. It can be based on rolling trends or from the whole of the time frame of any index. Adjusted market value is most naturally suited to analysis of market segments through an index but can be produced for an individual property if the full history of revaluations is available. The data requirement is purely a history of capital values going back at least one major property cycle. It does not account for any structural change in the particular market.

Econometric equilibrium models

The perceived limitations of the investment value and adjusted market value approaches stimulated research into more sophisticated econometric modelling of markets. This research was predicated on the findings of PIA/CREFC Europe/IPF (2017) which basically suggested that:

- a market analysis approach rather than an individual property valuation was the preferred solution to the prudent value issue,

- the modelling needed to be able to recognise both occupier and asset market mispricing, and
- the asset value was a function of rental value and capitalisation rates,

The IPF (2020) report addresses the prudent value issue from these perspectives. The approach was to use long-term CRE data from MSCI, CBRE and JLL to generate models of the property market from a long-term perspective. There is an academic literature on market modelling fully set out in IPF (2020). The concept of an equilibrium *rental value* was developed by Hendershott and others (See Hendershott (1996), Hendershott, MacGregor and Tse (2002), Englund et al. (2008) and Hendershott, Lizieri and MacGregor (2010), among others). This equilibrium rent can be estimated from a long-run model based on long-run demand and supply conditions. IPF (2020) developed this sustainable rent model for the UK CRE market and in testing the model across the last two major downturns identified a format that worked the best in predicting the downturn a number of years prior to it actually occurring.

The IPF (2020) report also undertakes a similar analysis for capitalisation rates and merges the two elements to assess capital value under and over-pricing. After a comprehensive review of the literature on the various methods of determining cap rates, a range of approaches were tested. These were:

- CR Approach 1: Historical average
- CR Approach 2: Historical trends
- CR Approach 3: Econometric models
- CR Approach 4: Ex-ante methodology

The first two require past data of the level of cap rate and both can be applied by either taking the whole data available or by taking a rolling set of data for a defined number of periods.

CR Approach One is a straight average and mimics the approach of Crosby and Hughes (2011) and the initial work of the BOE (2015) to the exit cap rate in their modelling.

CR Approach Two takes a trend line through the data rather than an average. Both require a simple set of periodic observations of the cap rate through time.

CR Approach Three is based on econometric modelling and the model that worked best in testing was one based on the cap rate as the dependent variable with independent variables of the index-linked gilt (ILG) yield and the 4-quarter average of quarter to quarter real rental growth. IPF (2020) explored a substantial number of other models, but this model appeared to explain movements better than others.

CR Approach Four is a return to the investment value modelling process. IPF (2020) used the real risk-free rate, the sustainable risk premium and the long-run net rental growth expectations to derive the current cap rate to be applied to the sustainable rent to identify the sustainable capital value.

The testing of these various models showed that the econometric or ex-ante approaches performed best and are preferred over the average and trend models.

Overall, while error correction modelling goes beyond simple extrapolation of rents or values, it does presume a continuation of historical relationships when looking beyond the estimation period. For this reason, it has two major issues that needs more qualitative assessment. Firstly, where structural change is occurring, there may be variables within the models that capture it but much of the modelling does rely on data of what has actually occurred in the past. So it is likely that modelling will understate the impact of the changes. An example where historical relationships might be less reliable is retail, as relationships between rent and retail sales or consumer expenditure series are altered following the rise in online retailing. Logistics is another example where the modelling may understate the true long-term value.

A second issue is the impact of extraordinary events such as the pandemic. The postscript to Crosby, et al (2021) states that *"The research for this paper was undertaken well before the pandemic and so we have not addressed the issues raised specifically in the paper apart from a couple of footnotes. The Lucas critique supports the view that it is impossible to predict unforeseen events by examining past data and while we have not collated or tested the most recent data illustrating the effects of the pandemic, we are sure the modelling we have undertaken would not predict the extent of the impacts of COVID-19 on rental values in the UK. But what these models can do (and are doing within the UK central bank) is form the basis of stress testing markets for unforeseen events. By their nature we don't know what the next unforeseen event will be after COVID-19 ……., we can be sure there will be one."* (Crosby, et al, 2021)

Data requirements

Overall, the modelling process undertaken for IPF (2020) illustrated that the more sophisticated the modelling, the more accurate it became at predicting the extent of the 1990 and 2007 UK market downturns. However, it also illustrated that basic trend modelling using the simplest of data also picked up the major downturns with significant early warning periods.

More sophisticated modelling comes at a price. It requires significantly more data. The UK market has been used as the main testing ground for prudent value measures as it enables the full width of testing due to it being the most transparent CRE market in the world (JLL, 2022) with the longest running consistent performance measurement datasets. The Jones

Lang LaSalle UK Property Index, commenced in June 1967 while Investment Property Databank (now MSCI) has annual measures from December 1980, quarterly from December 2000 and monthly from December 1986. IPD also produced long-term annual indices for the Office/Retail/Industrial segments back to 1971 for total return, capital gain and income return. Rental growth started in 1976.

There is also a long running hypothetical UK property rent and yield series. The CBRE Rent and Yield Monitor commenced in the 1960s but has a continuous quarterly dataset from March 1972 onwards with local institutional market disaggregation. The CBRE Rent and Yield Monitor was first generated by Hillier Parker in the 1960s (which became CBRE after a series of company mergers) based on rent and yield estimates. It holds individual location rent point data for the UK quarterly from 1972 (initially there were some interpolations of bi-annual data). These locations shift through time, but continuous data is held for over 100 office locations, over 200 retail high street locations, over 50 retail park/warehouse locations and around 85 industrial locations from 1997 onwards.

Even with that level of CRE value data and other financial data, in order to implement the econometric analysis, some major data gathering over and above that which was already available was necessary. This related mainly to the supply-side floorspace and construction activity data and one member of the Reading/Cambridge research team spent some considerable time collating and constructing a long-run floorspace data set across the three main sectors of the UK CRE market. The outcome of this process was a stock series for the office and industrial sectors running from 1969, and a stock series for the retail sector running from 1974 onwards. If data issues are still major constraints in the most transparent market in the world, they will be very major constraints to delivering sophisticated analysis of markets across the EU (or more globally).

To determine the extent of the problem this research has identified the data necessary to implement each of the possible long-term value models and what data is available across the countries in the EU.

SECTION FIVE – DATA REQUIREMENTS OF THE MODELS AND DATA AVAILABILITY ACROSS EUROPE

Requirements

The review of the CRE market analysis literature includes a large number of studies since 2000 that are relevant to long-run equilibrium rent and capital value determination.

Modelling rental value

Tables 1-3 set out an analysis of the various studies and the data used in those studies for the modelling of respectively office, retail and industrial rents.

Table 1 – Data used for error correction modelling of office rents

Study	Location/period	Period	Rent/vacancy variables	Demand variables	Supply variables
Crosby et al. (2022)	United Kingdom	1967-2019	MSCI rental value index, JLL rental value index	Real GDP	Floorspace, interpolated using real construction orders
Chau and Wong (2016)	Hong Kong	1981-2013	Government rent and vacancy series for Grade A and Grade C offices	Finance and office-based employment series	Government estimates for stock of Grade A and Grade C offices
Bruneau and Cherfouh (2015)	Paris	1990-2013	BNP Paribas hedonic rent series, plus vacancy rate estimates	Regional total employment	BNP Paribas total office stock estimates
White and Ke (2014)	Shanghai submarkets	1994-2010	DTZ asking rents and vacancy rates	GDP and foreign direct investment	DTZ Class A floorspace estimates
Ibanez and Pennington-Cross (2013)	34 US MSAs	1990-2009	CoStar asking rents and vacancy rates	Office employment based on selected sectors	CoStar inventory of floorspace for MSA
Adams and Fuss (2012)	30 German cities	1991-2007	Prime rents, vacancy and availability rates in RIWIS database	Office employment based on selected sectors	Floorspace in database converted to occupied stock variable
McCartney (2012)	Dublin	1978-2010	JLL rental value index, Lisney vacancy rates	Real gross national product	Lisney office floorspace estimates
Hendershott, Lizieri and MacGregor (2010)	City of London	1977-2006	DTZ Class A rent estimates, CBRE availability rates	Financial and business services employment	Corporation of London floorspace estimates

Brounen and Jennen (2009a)	15 US MSAs	1990-2007	TWR hedonic effective rent estimate, CBRE vacancy rate estimate	Financial and business services employment	CBRE inventory of office floorspace in locations
Brounen and Jennen (2009b)	10 European cities	1990-2006	JLL prime rents and vacancy rates	Real GDP, service sector employment	JLL estimates for stock of floorspace
Ke and White (2009)	Shanghai	1991-2007	DTZ asking rents and vacancy rates	GDP, service sector employment, foreign direct investment	DTZ estimates of CBD office floorspace
De Francesco (2008)	Sydney, Melbourne	1974-2003	JLL prime rent estimates converted to effective rent, plus vacancy rates	Office employment based on selected sectors, real GDP, unemployment	JLL estimates for stock of floorspace
Englund et al. (2008)	Stockholm	1977-2002	Hedonic real rent series estimated by authors, published vacancy rates	Office employment based on selected sectors	Official office floorspace inventory extrapolated using net additions data
Mouzakis and Richards (2007)	12 European cities	1980-2001	DTZ prime rent series	Service sector output (gross value added)	DTZ floorspace extended using completions data
Stevenson (2007)	Central London submarkets	1990-2004	CBRE rent estimates converted to effective rent, plus vacancy rates	Service sector employment	CBRE stock estimates for submarkets
Hendershott, MacGregor and Tse (2002)	City of London	1977-1996	DTZ Class A rent estimates	Financial and business services employment	Corporation of London floorspace estimates

Hendershott, MacGregor and White (2002)	UK regions	1970-1998	IPD rental value index	Financial and business services employment	Floorspace, interpolated and extrapolated using real construction orders

Table 2 – Data used for error correction modelling of retail rents

Study	Location	Period	Rent/vacancy variables	Demand variables	Supply variables
Crosby et al. (2022)	United Kingdom	1967-2019	MSCI rental value index, JLL rental value index	Real household consumption	Floorspace, interpolated using real construction orders
Ke and White (2015)	Beijing and Shanghai	1999-2012	DTZ asking rent psm	Real income per capita (alternatives tested)	Stock of shopping centres/malls and department stores
Hendershott, Jennen and MacGregor (2013)	11 US MSAs	1982-2007	CBRE EA rent estimates and availability rates	Real retail sales	CBRE EA floorspace estimates
Ibanez and Pennington-Cross (2013)	34 US MSAs	1990-2009	CoStar asking rents and vacancy rates	Real retail sales	CoStar inventory of floorspace for MSA
Hendershott, MacGregor and White (2002)	UK regions	1970-1998	IPD rental value index	Real consumer expenditure	Floorspace, interpolated and extrapolated using real construction orders

Table 3 – Data used for error correction modelling of industrial rents

Study	Location	Period	Rent/vacancy variables	Demand variables	Supply variables
Crosby et al. (2022)	United Kingdom	1967-2019	MSCI rental value index, JLL rental value index	Real GDP	Floorspace, interpolated using real construction orders
Ibanez and Pennington-Cross (2013)	34 US MSAs	1990-2009	CoStar asking rents and vacancy rates	Industrial employment for selected sectors	CoStar inventory of floorspace for MSA

Not surprisingly, there is a bias towards modelling based on the most mature markets with the best quality real estate data. Historically, these have typically been office markets in mature economies based around major cities such as London and Paris or for panels of major cities in the US or Europe. Even for mature markets, the time periods studied are driven strongly by data availability, although researchers do usually strive for the longest time-frame possible. When modelling at a sub-national level, a recurring issue is consistency in spatial scales. Different variables can be based on different notions or definitions of what constitutes a city or region.

Data frequency is another major issue. Many studies have been restricted to semi-annual or annual estimation because either the rent, demand or stock variable is measured at a lower frequency than the others.

Data availability is an additional key issue. Rent and vacancy variables used in these studies have been almost always obtained from private sector, proprietary data sources at a cost to the research. Hong Kong was a major exception.

Property value data is normally more readily available than floorspace or vacancy in a European context. Availability is also an issue for floorspace, vacancy, stock variables as they are also normally obtained from private sector, proprietary data sources. Stock tends to be tracked at city rather than national level by such sources. Where public data on stock exists, it can be erratic and, in the UK Reading/Cambridge study, some extrapolation was necessary to join different series together.

Floorspace and floorspace change are arguably preferable to construction or completions data since the former not only measure the total stock, but changes will also pick up the effects of demolitions or changes of use that stem from obsolescence. Yet with very long time series for construction, it is possible to proxy the commercial property stock using a perpetual inventory approach that incorporates depreciation assumptions (see, for example, Rogers and Blake, 2013). This would essentially expand on what is done in country national accounts to estimate the overall stock of fixed capital.

There are some technical issues with the data. For example, the rent variables (whether asking rents, transaction-based rents or appraisal based rental values), often (but not always) reflect headline levels of rent that are not adjusted for incentives. These incentives to let can be major elements especially in weak occupational markets and can disguise the true extent of any occupier market downturn.

Demand variables have been normally obtained from public sources such as national or local statistical agencies. Employment series are more likely to be available at a local level than output-based measures. Many studies have used sector-specific employment measures (such as financial or 'office-based' employment) more frequently than sector-specific output measures. Again, private sector forecasting and consultancy firms in some markets hold more tailored employment and output variables for local level modelling.

Table 4 sets out the different demand and supply side data requirements of the different models across the three main sectors of commercial real estate markets

Table 4: Basic Demand and Supply Side Variables for Econometric Modelling of Sustainable Rents

	Office	Retail	Industrial
Demand	GDP/GNP Real GDP/GNP Total employment Finance, business services and office-based employment Unemployment Foreign Direct Investment	Real household consumption Real income Real retail sales Real consumer expenditure	Real GDP Industrial and other related sector employment
Supply	Total floorspace Office stock by grade Vacancy rates	Total floorspace Floorspace of malls/centres and major stores Vacancy rates	Total floorspace Vacancy rates

Modelling capitalisation rates

The Reading/Cambridge (IPF, 2020) study of long-term values identified a number of attempts to model capital values and capitalisation rates from the academic literature. Given the detailed work on sustainable rents indicated above, the capital value model for the CRE market was based on sustainable rent capitalised at the sustainable cap rate. The literature identified a number of basic indicators used for the determination of cap rates.

The basic Gordon (1956) model is predicated on the capitalisation rate being a function of the target rate of return less the expected growth ($k = r - g$) where k= cap rate, r = target or discount rate and g = expected growth. The target rate is the risk adjusted risk free rate based on a risk-free rate plus risk premium. Where g is real, the risk-free rate should also be based on

real interest rates. Where g is nominal, the risk-free rate should also be nominal. For long-term equilibrium values, these drivers should also be sustainable through time rather than based on current levels. Expected growth is net of depreciation unless the model is expanded to include d = depreciation rate (k = r – g + d).

Ambrose and Nourse (1993) used the interest rate spread between long-term bond and short-term bond rates to proxy expected inflation. Jud and Winkler (1995) tested the role of risk premium on cap rates. Sivitanides et al. (2001) investigated the relationship between cap rates, the discount rate and rental growth. Chervachidze et al. (2009) and Chervachidze and Wheaton (2013) improved the detail of the Sivitanides modelling of cap rates by introducing two new variables, the degree of general risk aversion in the economy and the availability of debt. The last two papers found that that local fundamentals do not affect the cap rate but they are driven by national drivers of debt availability and reduced risk aversion. This may be a function of timing of data in the run-up to the GFC, where local market and asset characteristics may have been subsumed in the drive to find more stock to acquire. The data for debt availability was the annual change in total debt outstanding to GDP ratio.

Duca and Ling (2018) model the time series variation of CRE risk premia and use survey data of risk premia as their source. They found that cap rates are positively related to required returns and negatively related to the expected growth rate of rental income in a long-run relationship. Short-run changes in cap rates are strongly driven by a tendency for actual cap rates to move toward their long-run equilibrium. Wheaton (1999) also shows that prices or rents are typically mean-reverting. But Sivitanides et al. (2001) showed that investors in the US are not rational in the sense that long-run rental growth expectations are pro-cyclical. This mimics the forecasting literature which tends to include momentum; when values are rising the forecasts suggest that will continue and vice-versa. This is the reason that the 1990 occupier market (rent) crash in the UK was not predicted by the DCF modelling taking place in the late 1980 which used current rents plus momentum forecasts.

This irrationality produces a situation where cap rates are negatively related to the rent-ratio between current real rent and long-term average real rent. During a period of high real rents, cap rates are lower, implying that investors expect higher income growth in the future. Chen, Hudson-Wilson and Nordby (2004) also showed a negative relationship between the rent-ratio and cap rates. Hendershott and MacGregor (2005a) found the opposite in the UK. However, when they repeated their research with US data (Hendershott and MacGregor (2005b), they also found the negative relationship, suggesting UK investors were acting rationally but US investors were not. However, there have been very few efforts to confirm this surprising finding for the UK market.

The risk-free rate may seem to be one of the more basic indicators in any modelling, but Rachel and Smith (2015) investigated the reason why the world long-term real interest rate fell over the previous 30 years. Among other things they found an increase in the spread between the risk-free rate and the return on capital. They also showed that the shift in supply and demand

for safe assets may also play a role in the downward pressure on the risk-free real rate and there is a continuing debate over the long-term natural level of risk-free rates (see for example, Gourinchas and Rey, 2019).

The two capitalisation rate models developed for the IPF (2020) study were an econometric model and an Ex-Ante model using expected growth rates and target rates. That study also looked at both historical trends and historical average yields or reversion to the mean. The data required for most of the econometric and past trend models is based on past capitalisation rates, real interest rates, inflation, risk premia and rental growth rates. The literature identifies the detail of the data, dependent upon the model used and includes both past series and future expectations. Trying to identify indicators of structural change is a major challenge.

The next section investigates what data is available publicly.

Publicly available data across Europe

There are some major sources for general economic indicators across countries such as Eurostat, OECD and World Bank as well as individual country statistics.

Eurostat has, for example, data on a number of themes at a country specific level, concentrating on the 27 EU countries but including a number of other countries in its various datasets. The themes are:

- General and regional statistics/EU policies
- Economy and finance
- Population and social conditions
- Industry and services
- Agriculture, forestry and fisheries
- International trade
- Transport
- Environment and energy
- Science, technology and digital society

Relevant demand and supply side datasets include:

- *GDP and household expenditure* – 38 countries – Quarterly from Q1 1995 –countries include the EU 27 of European countries. The list is Belgium, Bulgaria, Czechia, Denmark, Germany (until 1990 former territory of the FRG), Estonia, Ireland, Greece, Spain, France, Croatia, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Hungary, Malta, Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Finland, Sweden plus Montenegro, North Macedonia, Albania, Serbia, Bosnia and Herzegovina, Kosovo (under United Nations Security Council Resolution 1244/99) United Kingdom, Switzerland, Iceland, Norway and Turkey.

- Unemployment monthly from 1983 for the EU 27 plus Iceland, Norway, Switzerland, United Kingdom, Turkey, United States and Japan.
- *Construction* - monthly volume index from 1980 broken down into construction, buildings and civil engineering. Main data starts from about 2000 onwards and includes the EU 27 plus Norway, United Kingdom, North Macedonia and Turkey.
- *Sector specific demand series* include retail trade volumes monthly from 1991 onwards (but only for a few countries) with most countries covered from 2000 onwards. The countries included are the EU 27 plus Norway, Switzerland, United Kingdom, Montenegro, North Macedonia, Albania, Serbia and Turkey. They also include manufacturing statistics for the EU 27 plus from 2005 (EU 27 plus Iceland, Liechtenstein, Norway, Switzerland, United Kingdom, North Macedonia, Albania, Serbia, Turkey and Bosnia and Herzegovina).

Financial data includes

- *Inflation* - monthly from 1996 for the EU 27 plus the United States, Iceland, Norway, Switzerland, United Kingdom, North Macedonia, Serbia and Turkey. Not all countries have a full series.
- *Long-term (10 year) Government Bond rates* - Monthly from 1980, full coverage of all 27 EU countries from around 2005. Short-term interest rates not available for more than around 8 countries

There is no data on direct commercial real estate prices or vacancies but there is data on residential real estate prices for 31 countries across Europe (Quarterly from Q1 2005). European countries include Belgium, Bulgaria, Czechia, Denmark, Germany (until 1990 former territory of the FRG), Estonia, Ireland, Spain, France, Croatia, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Hungary, Malta, Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Finland, Sweden, Iceland, Norway, Switzerland, United Kingdom. The lack of CRE data is acknowledged and there have been initiatives to start remedying this deficiency; for example, Eurostat (2017) report on commercial property price indicators: sources, methods and issues (see also Hill and Steurer, 2020). We have not undertaken any rigorous review of the quality of the European-wide data set out above, but we would hypothesize that generalised construction data would hide some major issues with the consistent identification of property type within CRE markets.

There are also a series of regular sentiment series. For example, surveys of retail sales include expectations of sales, employment, orders, etc. over the next few months, undertaken monthly, and a similar survey is carried out monthly for financial services.

OECD is more global and has detailed data on 55 countries of which 26 are within the European zone. These include 22 EU countries and 4 others to include Austria, Belgium, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia,

Lithuania, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Turkey and the United Kingdom.

The key statistics at the country level include long-term measures such as GDP, industrial production, retail trade volume, construction, total manufacturing, long-term interest rates, consumer prices, total employment and unemployment rates.

OECD have developed data on regions and cities within individual countries and economic and financial statistics are available for certain indicators. For example, for cities across 21 countries in Europe, there is OECD data on demographics, real GDP growth, a range of employment and unemployment data and household disposable income. For regions within those 21 countries, there is data on different aspects of the economy at the regional level.

As with Eurostat, OECD has housing price data but not commercial real estate price or value data. The World Bank mimics much of the basic financial and economic data from OECD and Eurostat but covers a wider range of countries.

To summarise, there is data to support the demand side of the modelling process in the public domain from these major international organisations and there is house price data to support any residential market modelling. Residential is not within the scope of this research.

The second source of data is National CRE data in the public domain. Even in the UK, classified as the most highly transparent market globally (JLL, 2022), there are few examples of nationally collected, structured and freely available, CRE data. The required property-based elements of the modelling process are not in the public domain internationally nor are they the subject of major data collection within national statistics. The UK Office of National Statistics collects virtually no information on real estate values other than for property company (REIT) prices.

The Federal Statistics Office of Germany and Stabel Belgium have construction and residential price indicators but no value statistics for commercial real estate. Statistics Netherlands also has house prices and construction prices from 2015 but no commercial real estate series.

France does have commercial rent statistics from March 2005 for Metropolitan France as well as housing and construction price indices. It is therefore an outlier as far as commercial real estate price data is concerned.

In 2015 and 2016, the European Systematic Risk Board (ESRB, 2015; 2016) identified both real estate as a major contributor to the financial crisis and the lack of commercial real estate data as a major constraint to financial stability policy making. They observed that *"Past financial crises demonstrated that unsustainable developments in real estate markets may have severe repercussions on the stability of the financial system and of the economy as a whole. Adverse real estate market developments in some Member States, both in residential real estate (RRE) and commercial real estate (CRE), resulted in large losses in the past and negatively impacted*

the real economy. This reflects the close interplay between the real estate sector, funding providers and other economic sectors, and the strong feedback loops between the financial system and the real economy, reinforcing any negative developments." (ESRB, 2016, p1).

They concluded that *"Establishing a more harmonised framework for monitoring developments in the RRE and CRE markets, the segments of the real estate sector most relevant for financial stability purposes, is therefore crucial to ensure early identification of vulnerabilities that could lead to future financial crises. Policymakers need to have a certain set of relevant information available, including a reliable set of key indicators, to help identify the build-up of systemic risks and assess the potential need for macroprudential intervention. In addition, these indicators can play an important role in determining whether and when to tighten or release the harmonised macroprudential instruments targeting lenders that are available under Union law."* (ESRB, 2016, p2). A similar set of indicators are needed for the assessment of prudent value.

These observations were based on the ESRB (2015) report on CRE and financial stability which concluded that *"data on CRE are in general scarce, incomplete or inconsistent – especially compared with RRE data – making it difficult to describe accurately and compare risks in and across national markets."* (ESRB, 2015, p3). While the Eurostat (2017) report shows some progress, it has been slow and CRE data remains largely in private hands.

Private CRE data across Europe

The sparse nature of freely available commercial real estate price data in the mature economies of Europe is in stark contrast to the significant databases in private hands. These sources have been developed for a number of purposes ranging from the detailed performance measurement of assets and benchmarking with other similar segments, portfolios and assets to marketing of the consulting firm. Most of these sources are either appraisal-based or judgment-based in nature, where judgements might be informed by knowledge of transactions, but the series are not directly derived from transactions (see Crosby and Devaney, 2019). Data from these sources has been used/purchased for real estate modelling purposes within studies set out in the literature review. They are also used to provide commentaries on different segments across CRE markets in Europe.

MSCI are the largest providers of CRE investment performance data and have a global reach. Tables 5 and 6 set out their global annual index size and coverage.

Table 5 : CRE Market Size and MSCI Coverage Estimates – MSCI Global Annual Index Properties

Country	Estimated Market Size 2020 (US$ Billions)	Estimated Market Size 2021 (US$ Billions)	MSCI Annual Index Coverage 2021 (US$ Billions)	No of Properties 2021	Coverage Ratio (%)	Inception dates for Annual Index (Europe)
Australia	347.7	385.6	148	1645	38.40%	
Austria	49.8	50.8	7.3	236	14.40%	Dec-03
Belgium	65.8	64.9	11.6	205	17.80%	Dec-04
Brazil	49.6	49.5	3.4	141	6.90%	
Canada	363.9	420.9	135.9	2390	32.30%	
Czech	31.8	32.9	4.8	116	14.70%	Dec-04
Denmark	83.6	91.5	4.5	178	5.00%	Dec-99
Finland	101.2	104	35.6	2108	34.20%	Dec-98
France	500.4	513	233.5	6990	45.50%	Dec-97
Germany	684.4	712.4	110.9	2767	15.60%	Dec-95
Hungary	12	12.6	0.9	47	7.20%	Dec-04
Ireland	36.5	36.8	13.2	486	35.80%	Dec-94
Italy	145.8	150.6	35.5	1866	23.60%	Dec-02
Japan	939.9	947.1	215.3	4642	22.70%	
Luxembourg	9	8.7	2.3	34	26.20%	Dec-16
Netherlands	210.3	218	81.6	3665	37.40%	Dec-94
New Zealand	23.6	27.5	12	460	43.70%	
Norway	66.9	78.2	27	811	34.60%	Dec-99
Poland	55.6	52.8	8.2	264	15.60%	Dec-04
Portugal	33.4	34	11	1467	32.40%	Dec-99
South Africa	46.3	41.7	23.9	2224	57.40%	
South Korea	105.1	106.1	35.4	173	33.30%	
Spain	128	128.3	28.6	1179	22.30%	Dec-00
Sweden	293.7	303.3	130.8	5273	43.10%	Dec-83
Switzerland	324.2	346.2	124.4	3573	35.90%	Dec-01
United Kingdom	768.5	850.4	290.6	11275	34.20%	Dec-80
United States	3,650.60	4,116.90	541.9	5128	13.20%	
MSCI Global Annual Index	9,127.60	9,884.70	2,278.20	57887	23.00%	

Source: *MSCI Real Estate Market Size Report 2021-2022* (https://www.msci.com/documents/10199/8f62c2a3-8374-cbf9-a7d2-a8c2c5e63e62#:~:text=information%20on%20individual%20real%20estate,investment%20portfolios%20was%20%242.5%20trillion) and Individual Index Fact Sheets

Table 6 : CRE MSCI Market Size and Coverage Estimates – Other Countries

Others	Estimated Market Size 2020 (US$ Billions)	Estimated Market Size 2021 (US$ Billions)	MSCI Annual Index Coverage 2021 (US$ Billions)	No of Properties 2021	Coverage Ratio (%)
Bulgaria	1.2	1.6	Combined Total Estimated at around 0.85	25	Estimated at around 5%
Romania	12.2	11.9			
Slovakia	5	4.6			
China	668.3	791.3	26.5	98	3.30%
Hong Kong	356.3	365.9	82	206	22.40%
Indonesia	15	17.6	2.1	64	11.90%
Malaysia	31	33.4	14.1	258	42.10%
Singapore	194.3	192.9	70.4	397	36.50%
Taiwan	65.2	67.9	4	26	5.90%
Thailand	33.1	32	7.2	225	22.70%
Total Global Coverage (incl. Others)	10,500.30	11,403.60	2,484.60		21.80%

Source: *MSCI Real Estate Market Size Report 2021-2022 and MSCI index factsheets* and author estimates

Another pan-European dataset is being developed by the European Association for Investors in Non-Listed Real Estate (INREV). It has a quarterly index of data across Europe commencing in 2014. At present it does not have the longevity needed to operate long-term equilibrium value analysis. It is also dominated by the four largest markets of the UK, Germany, France and the Netherlands with 80% by value within these markets. These are the only markets where country level data is published. But the data covers 20 European countries, so it is a potential future alternative to MSCI. These countries are Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland and the UK. As at September 2022, the number of properties included was 6,615 with a combined market value of 214.5 billion euros. It is still small by MSCI standards but is being increasingly supported by European investors.

Property Market Analysis is a private company specialising in global real estate data which claims to be the "world's leading independent real estate research consultancy". It has an extensive dataset for the UK (detailed later in this section) and also operates within the US, Europe and Asia Pacific markets. Its core markets are offices, retail, logistics and hotels and it has city level data for 21 locations in the US and 15 cities across Asia Pacific in Australia (4), China (4), Hong Kong, Japan (3), Malaysia, South Korea and Singapore.

In Mainland Europe, 17 countries are covered (Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Luxembourg, The Netherlands, Norway,

Poland, Portugal, Spain and Sweden). The 29 cities covered are Vienna, Antwerp, Brussels, Prague, Copenhagen, Helsinki, Lille, Lyon, Marseille, Paris, Berlin, Cologne, Dusseldorf, Frankfurt, Hamburg, Munich, Stuttgart, Budapest, Dublin, Milan, Rome, Luxembourg, Amsterdam, Rotterdam, Oslo, Warsaw, Lisbon, Barcelona, Madrid and Stockholm. The European list of locations matched to the four main property segments identified above can be seen at https://www.pma.co.uk/home/files/PMA%20European%20Coverage.pdf. The reported data availability for these European locations is quarterly including rents, yields, capital values, vacancies, starts, net additions, and net absorption.

These are by no means the only CRE datasets in private hands that have the potential to offer long-run global property market data. Real Capital Analytics, now part of the MSCI group, claims to be "the industry's only global real-time database of commercial real estate transactions" (MSCI indices discussed above are valuation based) having recorded over $40 trillion of commercial property transactions linked to over 200,000 investor and lender profiles during a 20 year + time period. It also links to a number of specialised datasets for CRE in Canada, Germany, China, US, Portugal, Australia, Hong Kong, South Korea, France, Austria, Malaysia, Japan, India, Brazil, the Netherlands and South Africa. Some of these are highly localised, such as "The Network" in Canada, serving two territories only, and it includes RIWIS in Germany.

The RIWIS dataset was used by Adams and Fuss (2012) for their study of rents in 30 German cities between 1991 and 2007 (See Table 1). RIWIS produce the German Property Index which is a property-performance-index, calculated on the basis of available market data collected by RIWIS. The GPI provides the total return, based on the capital growth return and cash flow return. The index draws upon market data for 127 German cities, covering the office, retail, residential and logistics markets. Results can be disaggregated by region and sector as well as by city. MSCI also have a German Index (see Table 5).

A variety of international property consultants produce regular publicly available reports including rent and yield statistics for a variety of European locations. Examples include (in alphabetical order) BNP Paribas, CBRE, Colliers, Cushman and Wakefield, Knight Frank, JLL and Savills. In addition, a number of data agencies also collect property data on Europe including Capital Economics and PMA. Other sources include Statista, who for around US$500, will provide data on unspecified European commercial property markets under the following headings - 1. Overview, 2. Investment market, 3. Office real estate, 4. Logistics and warehouses, 5. Retail and 6. Leading companies.

In order to identify the type of data held by private consultants more accurately, specific requests were made to the nine organisations identified above to verify the type of data held in the firms' databases, the length of any time series and the level of disaggregation. Replies detailing the data sets held within these organisations were received from five of these organisations; Capital Economics, CBRE**,** Cushman and Wakefield, Knight Frank and Savills.

The results are summarised alphabetically below.

Capital Economics covers 21 European countries including some of the less transparent or CEE countries of Czech Republic, Greece, Hungary, Poland, Romania, Russia, and Turkey. They track office market data on London and major regional cities in the UK and industrial data for major regions. In the rest of Europe, they have data for major cities for industrial, retail and office markets, plus some national and regional aggregations. Specific locations include Vienna, Brussels, Antwerp, Helsinki, Paris, Lyon, Frankfurt, Munich, Berlin, Hamburg, Athens, Dublin, Rome, Milan, Amsterdam, Rotterdam, Lisbon, Madrid, Barcelona, Prague, Budapest, Warsaw, Krakow, Bucharest, Moscow, Istanbul, Copenhagen, Oslo, Stockholm, Zurich, and Geneva. The data includes mainly rents and yields but, in some locations, also includes capital values, returns, completions, vacancy, take up, future completions, and investment volumes. The data has a time series of 15-20 years, longer for the more mature European markets.

CBRE hold data for 29 European countries and property market segments including offices, retail, logistics, data centres and hotels. The data includes 66 European cities. The data is collected quarterly and extends to over 450 individual office locations, around 250 retail and nearly 150 industrial locations across their European and Middle Eastern region (EMEA). The type of data collected includes prime rents, rent-free periods, prime yields, vacancy rates, total stock, completions, take-up and investment volumes. The precise amount of data and time series varies by country and location but some rent and yield data for mature markets goes back to the 1970s. The Hotel and multi-family residential data starts in the 2010s. CBRE are not specific about the starts dates of their data for less mature European markets, but it is prior to 2010 giving at least a 15-year time series.

Cushman and Wakefield have a highly disaggregated dataset of European rent and yield series across 33 countries with approaching 300 office rent points, over 250 retail high street, over 150 retail parks and more than 100 logistics and light industrial rent points. The time series are variable with some annual data going back to the early 1980s and quarterly data from 1993. But the vast majority of rent points have at least a ten-year history across all segments. In the office segment there is a variety of stock, take-up, availability and completions data for over 200 rent points with time series of 10 years or more. The less mature countries and those in CEE are Bulgaria, Cyprus, Czech Republic, Estonia, Greece, Hungary, Latvia, Lithuania, Macedonia, Poland, Romania, Serbia, Slovakia, Slovenia and Turkey.

Knight Frank monitor 49 cities across 22 countries for office, retail and industrial segments (46 office, 39 retail and 47 industrial). These are prime locations within each city and, in addition, a number of secondary locations are monitored for offices. They collect data on rents, yields and investment volumes for all segments. In addition, they collect take-up for industrial and offices and stock, completions and vacancy for offices and report a comprehensive time-series from around 2000 onwards, although some of the larger markets have data back into the 1990s. The locations include the capital cities of CEE countries Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland and Romania, plus Poznań in Poland.

Savills report that they collect data on 33 city/city regions across 18 European countries disaggregated to five property segments (Office, Logistics, High Street Retail, Shopping Centres and Retail Warehouses). They hold prime/secondary, rental levels and cap rates for all segments; vacancy rates, growth rates and take-up for offices and logistics; and development completions and national level investment volumes for offices. The time series runs from 1990 in the UK and 2001 across mainland Europe and the locations include Poland, Czech Republic, Romania and Hungary.

For those firms who did not respond directly, there is some basic information in the public domain regarding their datasets.

JLL publish office rents for 23 European city locations with an index from 2005. BNP Paribas monitor around 40 city locations across Europe, and Colliers' European snapshot reports on 13 countries including Romania, Czech Republic and Poland. PMA list 36 core European city markets within 18 countries and their core coverage includes offices, logistics, retail high streets and retail shopping centres. They report they also monitor some other property segments. Overall, they have some coverage of 151 European sub-markets. The UK data is particularly disaggregated, and this is detailed later in this paper.

Private CRE data availability in the UK

The UK is the largest European commercial real estate investment market and is the largest market within MSCI outside of the US. This is the market which has therefore received the most attention regarding European long-term value modelling and the IPF (2020) study used the MSCI UK Quarterly Index and MSCI UK Monthly Index as its property market evidence base, splicing the two indices together to form a long-run quarterly index. In addition, it also used the JLL Property Index and the CBRE Rent and Yield Monitor.

The MSCI UK Quarterly Index covers around 25% of the UK market, compared to around 35% for the annual index (MSCI, 2022). Due to the large coverage and large size of the market in the UK, the MSCI data can be disaggregated by geography and sector, and also produces location (town/city) specific local market indicators.

It produces a range of measures including market rental value growth, capital growth and the level of capitalisation rate or yield for over the last 20 years. It can be disaggregated by reference to property type and geography. It can also be analysed by other property characteristics such as size or lease structure.

Examples of different levels of property type disaggregation offered to subscribers as standard are set out in Table 7. The analyses are also available by region and the regions include the City of London, London Mid-Town, London West End, Inner London, Outer London, South-East, South-West, Eastern, East Midlands, West Midlands, North-West, Yorks & Humber, North-East, Scotland, Wales, and Northern Ireland. In addition to the regional breakdown, there is also key

centre disaggregation available with 20 specific locations in London and 27 cities and major towns outside London disaggregated into retail, office, industrial and other.

Table 7 : Property Type Disaggregation within the MSCI UK Quarterly Index.

Main Property Type	Segments	Standard Sub Segments by Type and Geography
Retail	Standard Shop Shopping Centres/Malls Retail Warehouse Dept/Variety Stores Supermarket Other Retail	Standard Shop (Central London, Rest of London, South-East and Eastern regions and Rest of UK), Shopping Centres/Malls (In Town, Out of Town) Retail Warehouses (Retail Warehouses, Solus units and Rest of Retail Warehouses)
Office	Standard Office Office Park	Standard Office - Central London Standard Office - Rest of London Standard Office - Inner SE & Eastern Standard Office - Outer SE & Eastern Standard Office - Rest of UK Office Parks - London SE & Eastern Office Parks - Rest of UK
Industrial	Standard Industrial Distribution Warehouse	Standard Industrial - London Standard Industrial - Inner SE & Eastern Standard Industrial - Outer SE & Eastern Standard Industrial - Rest of UK
Residential		
Hotel		
Other	Healthcare Other	

At the top level, it can be disaggregated into the basic three main types of non-residential real estate, Retail, Office and Industrial which were used for the IPF (2020) study. It can also include Hotels and Other. The three main categories can be further disaggregated into a number of standard analyses, for example five different retail types (Malls / Regional / Super Regional Centres, Neighbourhood / Community / Convenience Centres, Retail Warehouse / Big Box Retail, Other Retail), Standard Offices, Office Parks and three Industrial categories (Warehouse

/ Distribution, Manufacturing / Production, Other Industrial). In reality, as this is an interactive database made up of individual assets, subscribers can aggregate the assets using a wide variety of criteria, although they cannot access data on the underlying assets themselves.

The JLL and CBRE property indices also used in the IPF (2020) study can also be disaggregated by property type and region. The JLL index is the longest running with quarterly three main sector continuous data back to 1977 and annual data back to 1967. CBRE have two major indices, a monthly index for the three main sectors and a hypothetical quarterly rent and yield monitor discussed earlier. As part of the IPF (2020) study, these three sources were compared and found to be highly correlated, and the use of all three within the various modelling processes used gave the same early warning results. The detailed analysis is freely available at https://www.ipf.org.uk/resourceLibrary/ipf-long-term-value-methodologies-in-commercial-real-estate-lending-comparison-of-property-market-indices--july-2020-.html.

In addition to the datasets used for the IPF (2020) study of long-term values, the UK also houses a number of property data companies that have long time-series on a variety of indicators. Property Market Analysis (PMA) started in the UK in the 1980s and has a particularly comprehensive set of UK data with detailed coverage of over 450 locations (listed in https://www.pma.co.uk/home/files/PMA%20UK%20coverage%20PROMIS%202020.pdf). Co Star is active in the UK, as well as in the US and Canada, and collects data on physical and tenure characteristics of individual properties and transactions in those properties where they are made publicly available. They claim to track 580,000 UK commercial buildings and have been operating in the UK for over 30 years providing "extensive and accurate" commercial real estate building information. EG Radius, formerly Egi, tracks individual property data, transactions and other specific asset and market data, similar to Co Star.

In addition to these various property performance measurement and individual asset based, data sets there are numerous internal databases held by the property consultants, some of which were listed in the section on data availability in Europe. Many of these firms had their genesis in the UK before expanding into mainland Europe and their UK databases are in those cases the most comprehensive that they hold.

The UK is therefore the largest and most transparent CRE investment market in Europe and the most comprehensively documented and researched.

Access to CRE data across Europe

The fact that data exists does not make it freely available. French (2020) undertook research for the European Group of Valuers' Organisations (TEGOVA) investigating the use of comparable evidence in property valuation. Part of that research involved asking some questions about access to property market information, in this case transactions. The question was not open-ended, and he gave some possibilities to the respondent organisations. These

included whether it was difficult to access such information or that the culture of the country did not encourage the sharing of information?

The responses were grouped by whether they came from a Highly Transparent, Transparent or Semi-Transparent country within Europe, according to the JLL Transparency Report (JLL, 2022).

In the highly transparent countries, 80% of the respondents rejected the notion that it was difficult to get information because of either access or culture. This dropped to 45% and 50% for the transparent countries. The responses from the semi-transparent countries across Europe was almost a mirror image of the highly transparent responses with 80% and 73% saying that both access and culture respectively were a major issue with value-based property market data.

The over-riding conclusion of the research into data availability and access is that national and local commercial property market data remains in private hands and is subject to payment for its release. The transfer of private information between market participants is subject to different attitudes and constraints within the different parts of Europe. The more information that is available for purchase within transparent markets, the less proprietorial the main property consultants become with their own information. It could be that they are relying on the quality of their analysis of information to add value to their services, rather than just relying on possessing more information than competitors.

However, for the purposes of identifying long-term relationships and trends within markets for the delivery of market value adjustment factors, it is clear that the necessary data is not in the public domain. IPF (2020) had to pay to use the privately held CRE data and any industry-wide modelling would come at a cost to the industry and/or to the regulators, if they chose to take on this task.

SECTION SIX – MARKET VALUE ADJUSTMENT FACTORS AND DATA DISAGGREGATION

Given its coverage of the market and the level of disaggregation, the MSCI UK quarterly index has been used to address an important question for this research. That is whether a significant level of disaggregation is needed to create legitimate market value adjustment factors. This is important for two reasons. It informs both the development of datasets to address long-term prudent valuations in the future and the veracity of existing outputs from existing datasets.

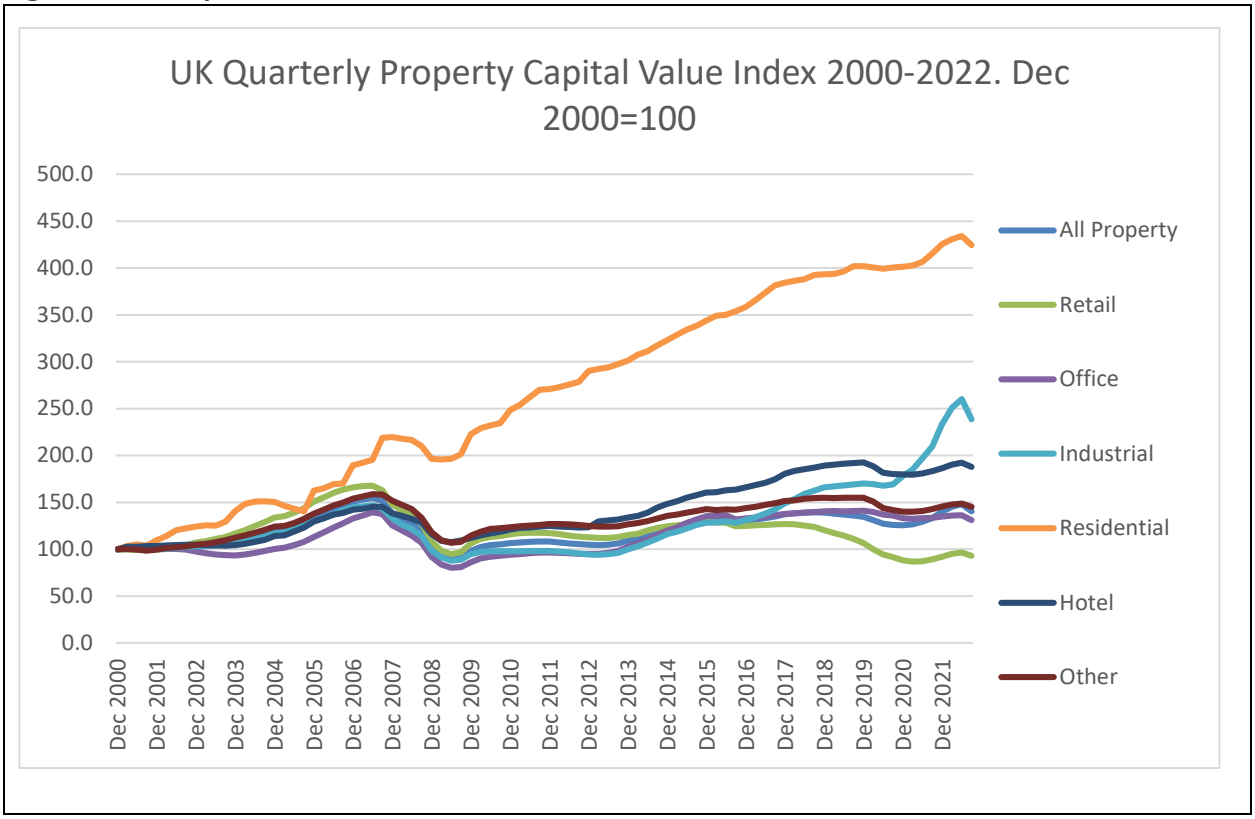
Given the difficulty in accessing individual asset data for analysis at reasonable cost, there is not surprisingly very little research into how individual asset performance mirrors that of its traditional segmentation within performance measurement databases. Fuerst and Marcato (2011) found that traditional segmentation by property type and geographical region's main use was to describe the broad characteristics of a portfolio rather than as a predictor of performance. New segmentations such as lease structure, yield levels and size of the property actually were better predictors of performance. There had been a number of studies prior to

this which found for the UK that sector was an important determinant of performance, but region was less important. (Hoesli, et al, 1997; Lee, 2001; Lee and Devaney, 2007). There is, however, a significant academic literature on specific asset risk versus systematic risk and how many individual assets are required to create portfolios that eliminate most of the specific risk (with systematic risk described as the volatility within real estate markets which cannot be diversified away). This is an important element for financial stability as most banks hold portfolios of properties and it is systematic risk that holds the greatest threat to financial stability, not the specific risk attached to individual assets. Callender, et al (2007) reviewed that literature and examined the systematic and specific risk within the IPD (now MSCI) databank. They concluded that a portfolio of just 30–50 properties can deliver significant risk diversification benefits but that full diversification is much harder to achieve, with 250 properties needed to achieve a tracking error of under 1% per year.

More recently, Reid (2019) used "asset-level data from over 9,000 office assets in the MSCI Global Annual Property Index to explore the performance of small portfolios (1 to 30 assets) over two separate five-year periods (2007–2011 and 2013–2017) in 16 national markets", He found that even quite small portfolios can substantially reduce volatility but that the results varied considerably across different markets and through time, so the results were not always consistent. This is important for this project as it raises the spectre that any results from analysis of one market are not necessarily going to be repeated across all markets within Europe.

However, the importance of sector over region in the UK can be shown by a simple analysis. Figure 2 illustrates the capital value index performance for the main sectors within the MSCI UK Quarterly Index.

Figure 2: UK Capital Value Index 2000-2022

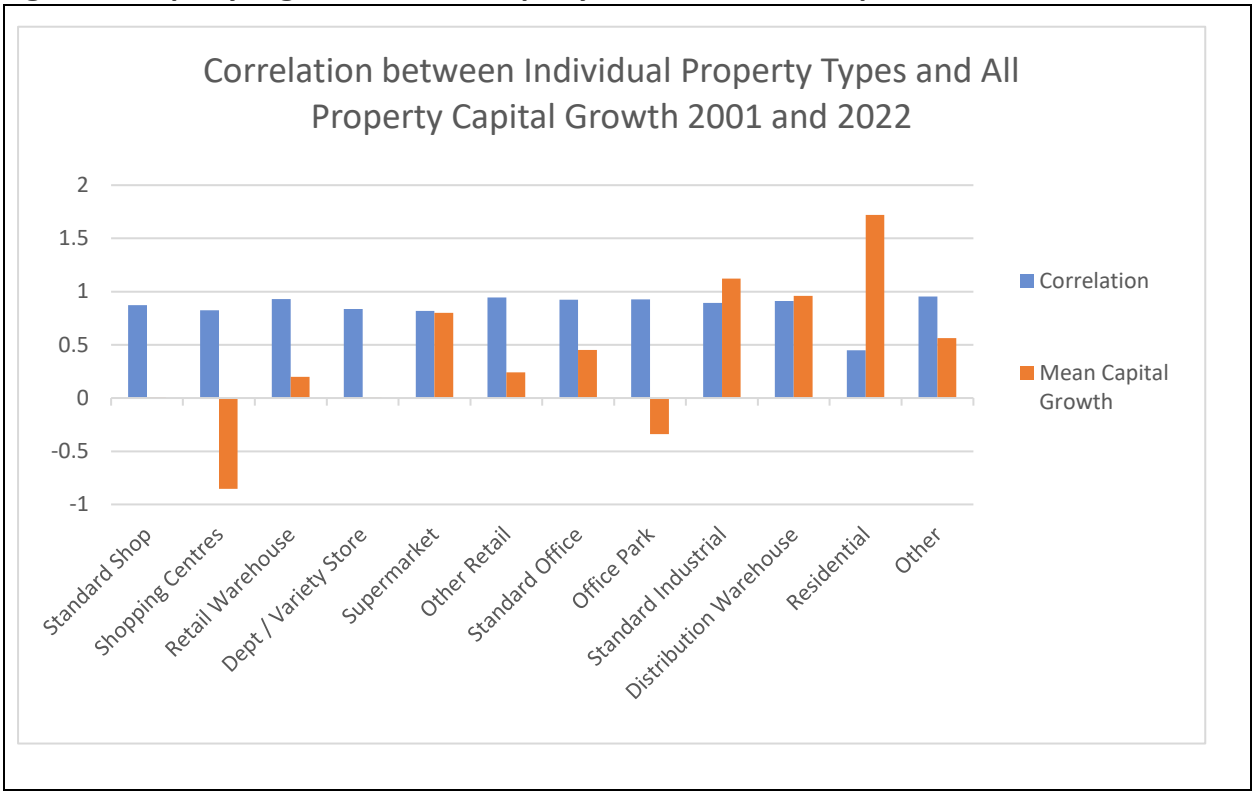


Source: Based on MSCI

It suggests that between December 2000 and September 2022, there has been some commonality between the different sectors, apart from residential. An initial conclusion is that commercial and residential investment markets are very different, and it is right that they have been separated for the purposes of this study. The correlation between the MSCI All Property quarterly capital value change and residential for the period is only 45%, much lower than for all the other sectors (apart from the sub-segment of healthcare, which is only 20%).

Within the commercial sectors, the largest differences in performance relate to retail and industrial and there is a well-documented debate on the impact of on-line shopping on property, with the rise of the warehouse/distribution sector at the expense of the high street. The retail sector has fallen in nominal value since 2000 by 7% overall while the industrial segment has risen in nominal capital value by nearly 140%.

Figure 3: Property Segment and All-Property Correlations and Capital Growth 2001-2022



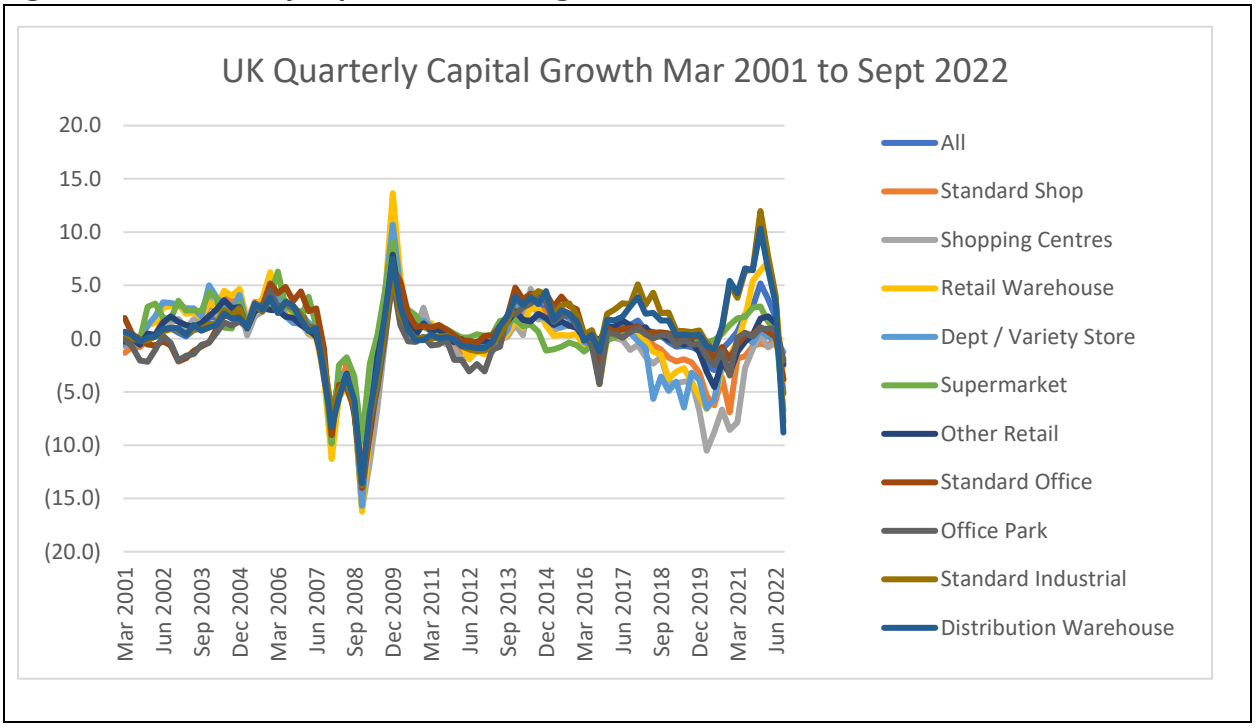
Source Compiled by authors from MSCI

The disaggregation to main sector only hides some additional significant differences within sectors. Figure 3 shows the average quarterly capital value change over the last 22 years of the different segments within the MSCI Index. High street standards shop units have remained static while shopping centres have fallen by over 50% in value. Retail warehouses have grown in nominal value by 10% and supermarkets by over 90%. There are also major discrepancies between standard offices and office parks with an over 40% increase in the standard office against a nearly 30% fall in office park values. Standard industrial and distribution/warehouse values have grown by over 100% with standard industrial outstripping the distribution warehouse values.

In contrast, the commercial sector correlations with the All-Property quarterly capital value change are much more consistent with a correlation coefficient consistently at 80% or more with industrial at 90% and offices at 95%.

These results suggest that while the individual sector performance varies, the shape of that performance is very similar and highly correlated, suggesting that an all-property measure should capture when CRE markets are over-heated and market values require adjustment The alignment of different sectors to the cycles is illustrated in Figure 4.

Figure 4: UK Quarterly Capital Value Change 2001-2022



Source: MSCI

However, the correlation factors do improve if they are related to the main sectors. The outcomes are set out in Table 8 and illustrate that, in all cases, disaggregation to sector-level does improve the outcome. Only the relationship between retail and supermarkets does not improve to over 90%.

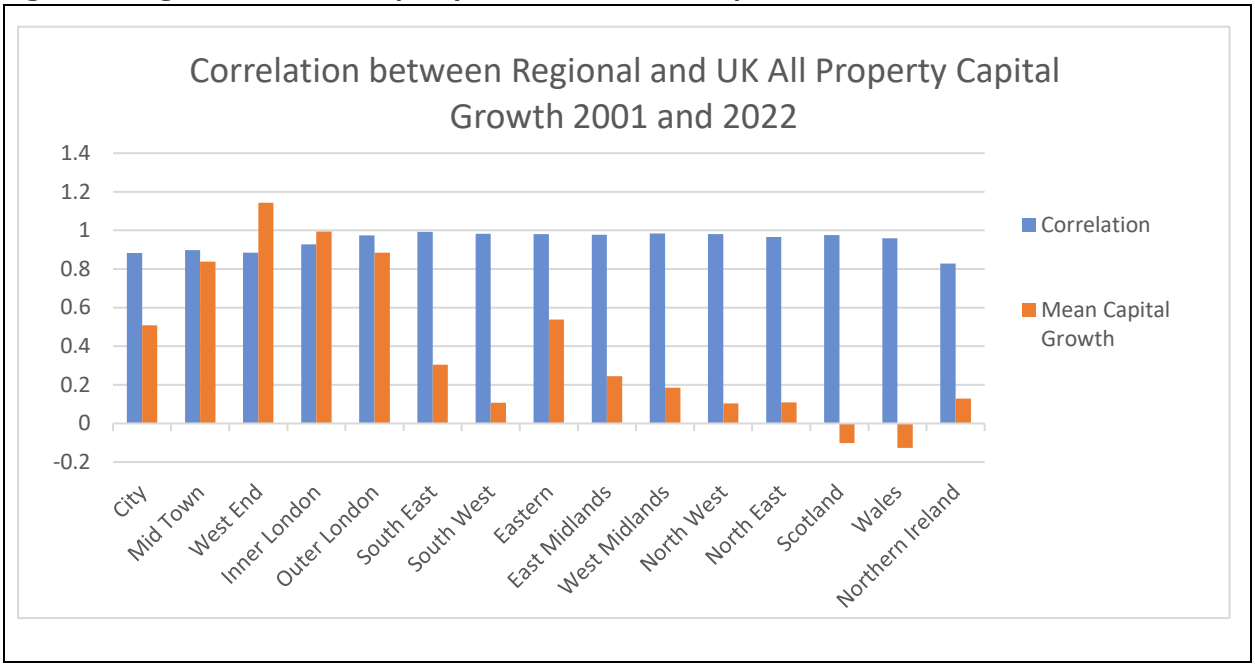
Table 8: Segment Correlations with All-Property and Office, Retail and Industrial Sectors 2001-2022.

	Correlation with All Property	Correlation with Retail, Office and Industrial Main Sectors	Improvement in correlation
Standard Shop	0.87	0.94	0.070
Shopping Centres	0.83	0.93	0.103
Retail Warehouse	0.93	0.98	0.046
Dept / Variety Store	0.84	0.93	0.096
Supermarket	0.82	0.82	0.007
Other Retail	0.94	0.96	0.013
Standard Office	0.92	1	0.076
Office Park	0.93	0.96	0.031
Standard Industrial	0.89	1	0.105
Distribution Warehouse	0.91	0.99	0.081

Source: Compiled by author from MSCI

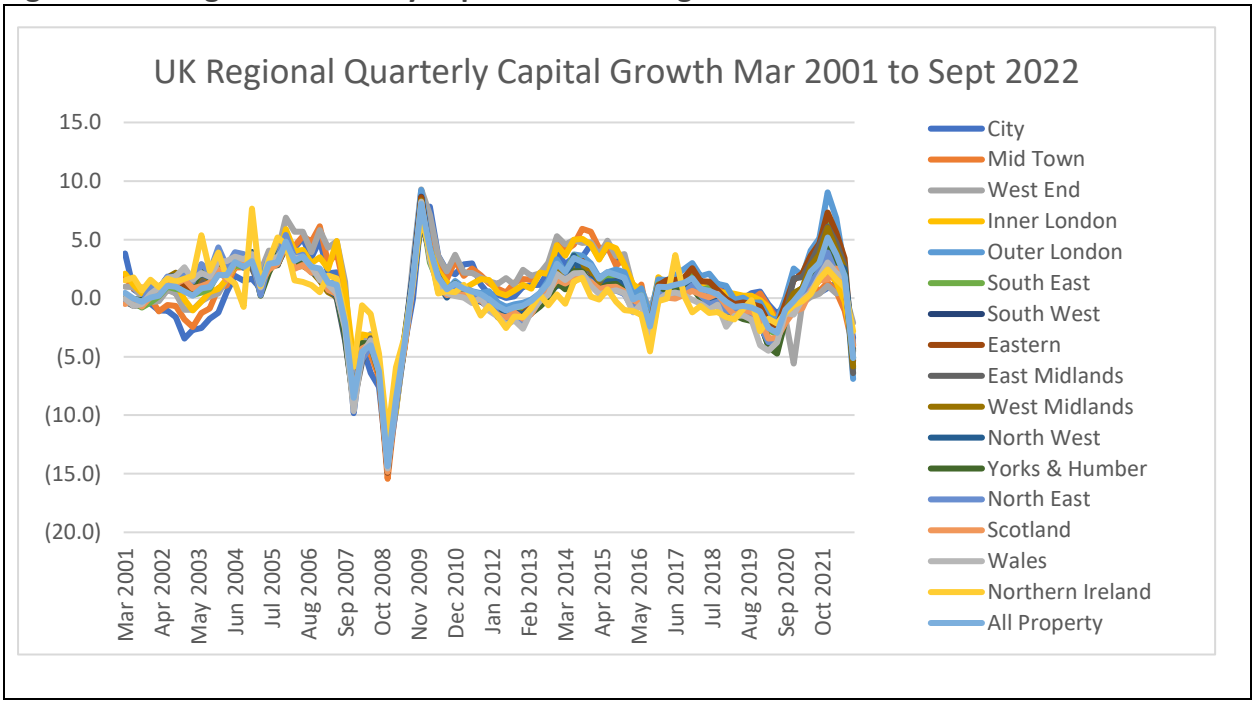
The picture of high correlations despite differences in the performance of the property segment is also true of regional differences. Figure 5 shows the mean All Property quarterly capital value change for the major UK regions and the correlations with the All-UK capital value change. The picture is very similar to the same chart for the property types. Despite the regional differences which stretch from negative capital growth in Scotland and Wales to over 1% per quarter in the West End of London, the correlations remain high with none less than 80% and most over 90%, and the synchronisation of capital value change cycles is illustrated in Figure 6.

Figure 5: Regional and All-Property Correlations and Capital Growth 2001-2022



Source Compiled by author from MSCI

Figure 6: UK Regional Quarterly Capital Value Change 2001-2022



Source: MSCI

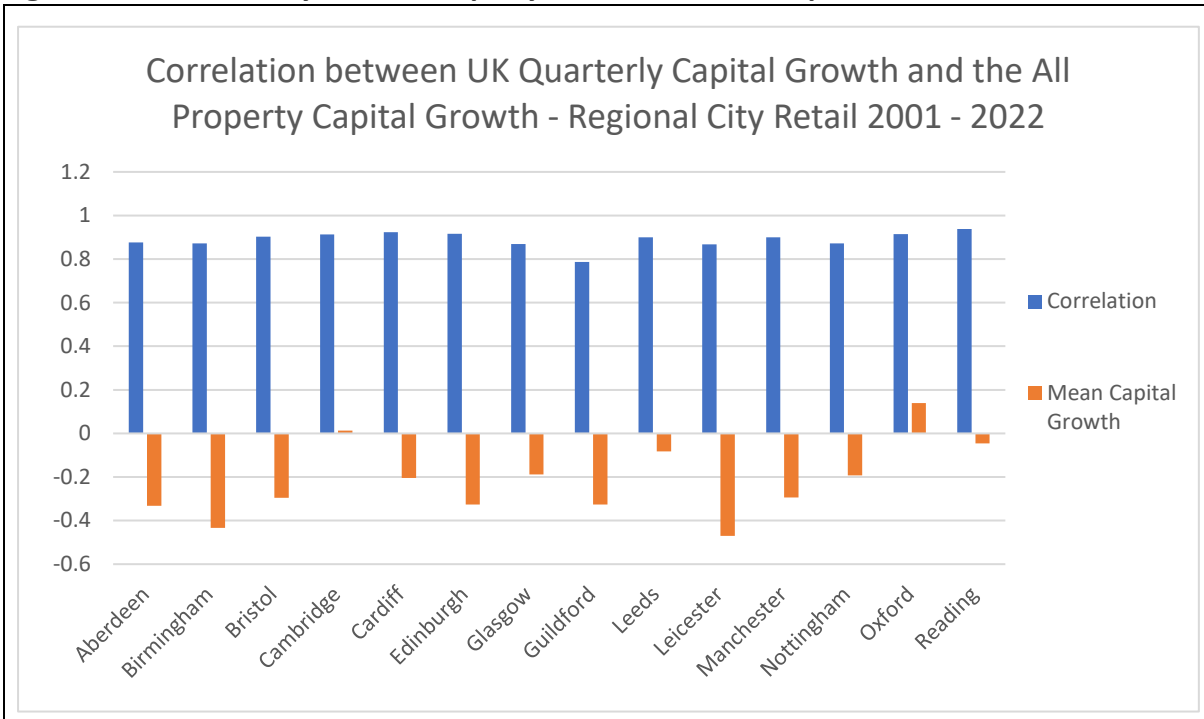
Given the level of disaggregation possible within the MSCI UK index, the analysis of the similarities in cyclical movements could be extended across an almost infinite number of variations across regions and property types, and it could be extended into various other

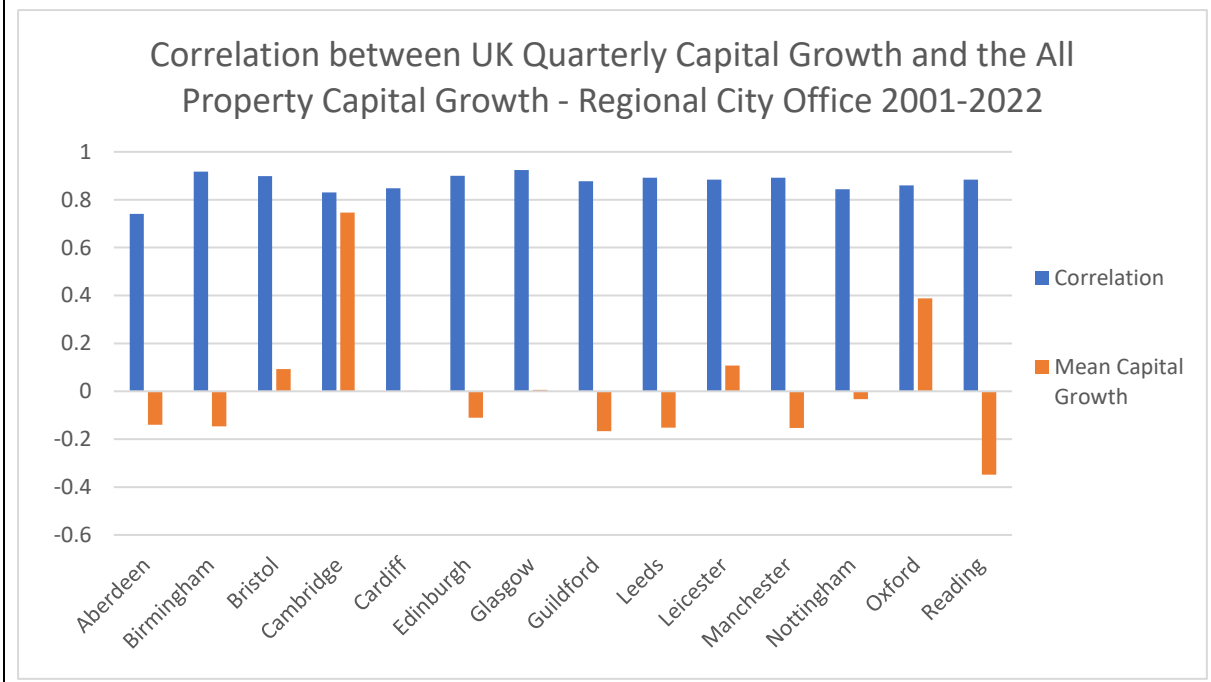
characteristics. However, this preliminary analysis has shown identical characteristics across questions of property type and region. These are that while different parts of the UK property market behave very differently, the shape of that behaviour is very similar, tied to market cycles that affect all commercial property investment.

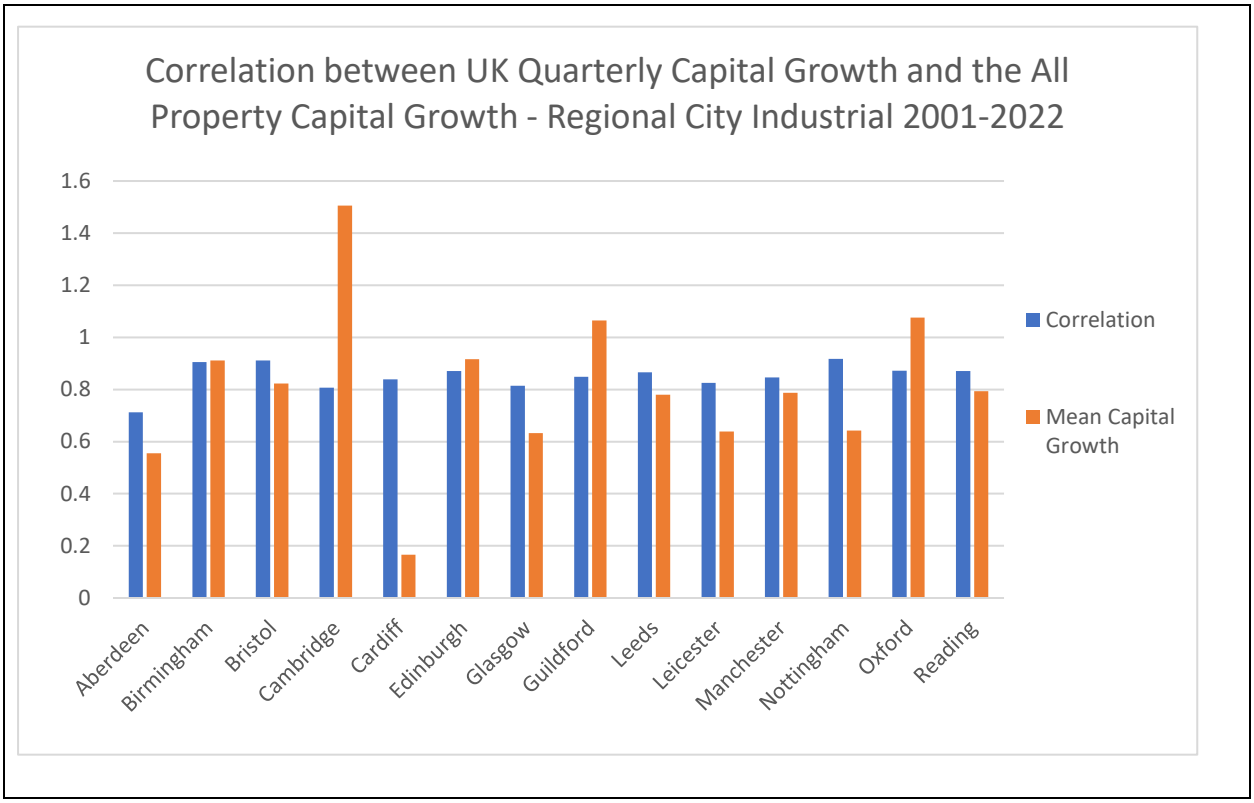
The main issue that stems from the particular set of research questions being investigated in this paper is the lack of data availability in many markets, including the lack of disaggregation of that data. There is a stark contrast between data availability in the UK and some of the other mature CRE markets in Europe and some of the emerging CRE markets in Central and Eastern Europe. This is a microcosm of the situation between mature and immature markets globally. That lack of data may be most easily rectified at major city level, so a legitimate question is the relationship between city level performance and the performance of the whole market. The final analysis of this part of the paper is to address the correlations between a number of cities and the All-Property performance, and against main sector performance.

The MSCI quarterly index has data on 30 city/major town retail locations across London and the rest of the UK, 33 office locations and 16 industrial locations. Out of London there are 14 centres with data on all three segments covering the period 2001 to 2022. We have analysed these outside of London markets. Figure 7 sets out the results for the three main segments where the quarterly capital value change has been correlated with the All-Property Index.

Figure 7: Individual City and All-Property Correlations and Capital Growth 2001-2022





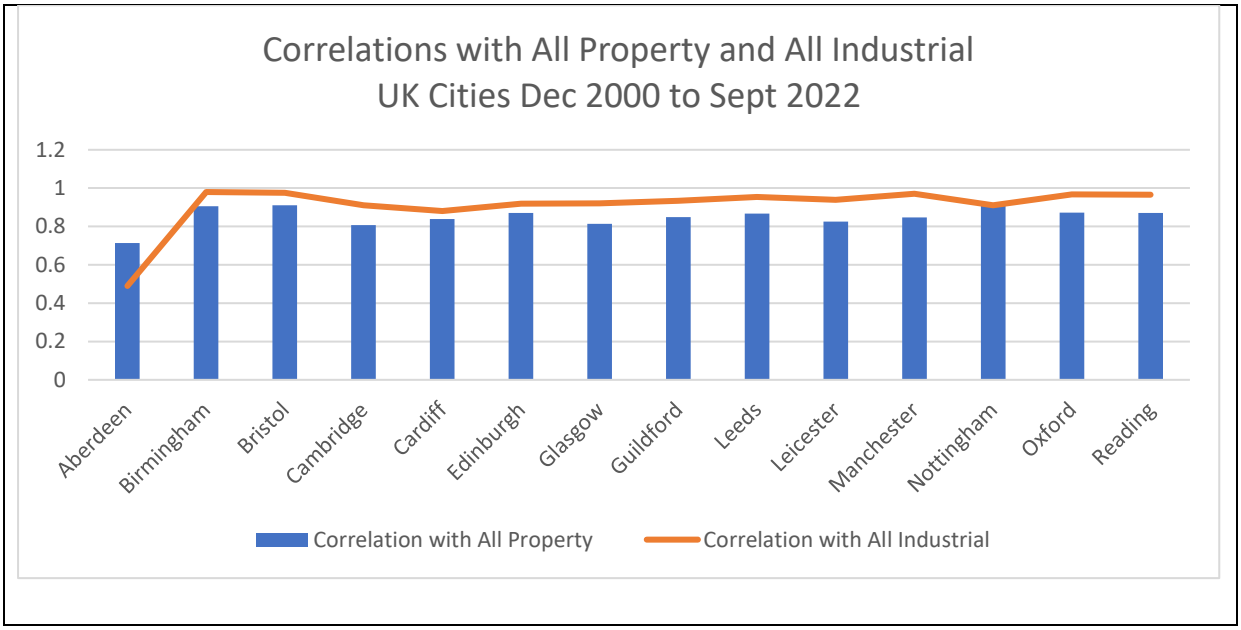


Source Compiled by author from MSCI

Despite the major differences in performance between say Cambridge and Cardiff industrial, Cambridge and Reading offices and Oxford and Leicester retail, the correlations are very similar. They are all around or above 80% with the exception of Aberdeen office and industrial.

Where the correlations are assessed against the main sector indices, the correlations generally improve as illustrated in Figure 8. But the picture is not quite so consistent as it was with the expansion of property types and the regional analysis. While all of the retail correlations improve, six of the office correlations actually fall and this is also the case for Aberdeen and Nottingham industrial. Overall, the average correlation increase using the main segments rather than the All-Property index across the 14 locations and 3 sectors is 4%, from 87% to 91%.

Figure 8: Individual City and Main Sector Correlations and Capital Growth 2001-2022



Source Compiled by author from MSCI

The conclusion is that a lack of disaggregation due to data constraints is not fatal to the hypothesis that high level through-the-cycle analysis of long-term prudent value will enable early identification of major mismatches between prices and sustainable long-term values caused by boom-and-bust cyclical movements in CRE values. But disaggregation across the UK market did provide some minor benefits to the detail of the analysis and improved the outcome of the modelling. And it should be noted that much of the econometric analysis within IPF (2020), which produced the best test results when compared to the 1990 and 2007 CRE market downturns, was undertaken at a sector level using sector specific inputs.

SECTION SEVEN – CONCLUSIONS

The overall aim of the research was to assess the practicality of implementing a long-term prudent value model as an alternative to the market valuation model for use within UK and European CRE lending markets.

The specific objectives of the research were to:

- Identify methodologies for the development of long-term valuation models and make recommendations for a preferred methodology.
- Identify how that might be developed across individual countries within Europe and further develop previous findings on data requirements and availability.
- Examine whether a common harmonized approach across individual countries within Europe is feasible and whether it needs to be applied at an individual property or market segment level.
- Provide guidance to national professional valuer organisations on their role in supporting the development of a rational and deliverable long-term value methodology.

The UK Central Bank and commercial real estate community were the first to seriously address the role that property valuation could play in resolving some of the financial stability issues raised by the GFC. The UK market therefore represents the most advanced case study and enables us to see what might be possible with the necessary developments in data availability. However, there are limitations and the findings of Reid (2019) suggest that the single case study results may not hold across mainland Europe or globally. But the UK has now spent well over 10 years on the issue of a more prudent valuation approach that could have signalled the requirement to reduce lending in the latter stages of the pre-GFC boom period. This work has identified a methodology and tested it against the last two major property market downturns. Since the Basel III prudent value framework was announced, the long-term valuation method produced from that work has been mapped onto it and a prudent value definition suggested. Prudent value is the lower of either market value or a through-the-cycle long-term value.

Prudent value is not market value. Market value does not fit the requirements of the Basel III prudent value framework. However, prudent value can be characterised as an adjusted market value. A long-term through-the-cycle value can be both higher and lower than market value, a situation specifically disallowed under the Basel III framework. Under the Basel III framework, market valuations in under-priced markets will exercise a major constraint on lending at a time when it would be prudent to encourage it. Through-the-cycle prudent value will constrain lending in an over-priced market which is when the vast majority of losses occur and when such constraint is needed. The case study analysis found that the early warning signals for the 1990 and 2007 downturns were at least two years.

The proposed prudent value method relies on the analysis of markets via segments of the market rather than the analysis of individual properties to produce market value adjustment factors. It is market analysis, not valuation. The existing market value basis at the individual property level is adjusted by a market segment-based adjustment factor. Prudent value cannot be left to the inconsistent assumptions of individual valuers valuing individual properties.

In order to implement this method across the whole of Europe (and globally) this research has examined the major constraint identified in the existing research; data requirements and availability. The long-term value method requires some past long-term data and it is unclear from previous research what data is available and how much segmentation is necessary to produce robust market adjustment factors. However, previous research has suggested that data availability is very varied across Europe from the mature Western European markets down to the immature Eastern European markets.

These questions were addressed by identifying the data the models need to operate them (both CRE and other economic and financial data), the availability of that data across the different countries within Europe, and by analysing the relative performance of national, regional and local markets across a range of property types within a UK case study.

The first result is that the data requirements of the different long-term equilibrium models have been identified. The various long-term market analysis models obviously require a range of different data across finance, investment, construction and real estate sectors.

The second result is that we have shown that data across all of these sectors exists at a national level but the level of disaggregation is very variable across Europe. The main issues arise from the lack of public domain real estate data, but there are CRE datasets in private hands. The major property performance datasets in private ownership concentrate on the major institutional real estate markets, such as the three largest (UK, France, and Germany). However, there is some systematic data collection for the less mature CRE markets.

MSCI cover 19 European countries in their global index and have collected some data in three others. That still leaves a considerable number of countries without this source of consistent long-term value data. However, this research reveals a significant and wide-ranging dataset in the private hands of real estate consultants, which includes many of the less developed markets. Combined with national and regional economic and finance data from global sources such as OECD and the World Bank, as well as Eurostat, there is national level, capital/major city-based real estate data of long enough duration to run some form of long-term market analysis in virtually all countries of the EU and across wider Europe. However, within the less mature markets, this data is often restricted to a few market segments, to the best prime property and to a small range of locations within the country.

The third result assess the relationship between the performance of different property market segments. The analysis of correlations between the performance of high level and local level segments is preliminary but confirms the existing research into the relationship between different segments within real estate markets. That is the segments tend to behave similarly and that there is a property market effect that ranges across all geographical and property type segmentations. In analysing the different shapes of value change between UK local markets and national markets, there was a slight gain in correlation between local level movements and national segment level movements, when compared to national all property indicators. But the overall correlations remain high. The overall conclusion is that an analysis of the equilibrium value at a low level of disaggregation, coupled with an individual property market valuation, will provide robust market value adjustment factors to be applied to an individual property market valuation. This needs to be further tested in more detail and with sophisticated statistical techniques.

Nonetheless, there appear to be small gains to be made from a more disaggregated analysis where data permits, such as in the UK and it is a necessary requirement if more sophisticated econometric analysis is required. However, the findings of Reid (2019 have already been flagged as a warning about relying on one case study country to make definitive conclusions on required levels of disaggregation, hence the need to further this line of research.

If the EU and the UK continue on the current path of introducing a prudent valuation framework to be Basel III compliant, a consistent and systematic approach needs to be found to operationalise the framework. The recommendations of this and the previous research are that:

1. It is virtually impossible to construct a robust, consistent prudent valuation regime at the level of the individual property.
2. It is possible to develop a relatively harmonised prudent value regime based on market analysis at a market segment level. A consistent and evolving regime which accords with the Basel III prudent valuation framework guidance is deliverable across the EU and the UK.
3. The regime should be based on the provision of asset specific market valuations which take into account specific asset characteristics coupled with centrally managed market adjustment factors, which can be developed and updated periodically based on long-term analysis of real estate market cycles.
4. There are some major constraints to implementation, not least that the necessary property market data is mostly in private hands and, in most jurisdictions, is not collated systematically outside of the major cities.

National regulators and CRE industry/valuation institutions need to collaborate and establish a model for reach individual country, and free the private data to run it. This will need regular funding and technical support as some of the models are highly technical and require specialists to operate them. National regulators and professional institutions need to be contracted with a funding stream so that regular, periodic adjustment factors can be identified. As datasets and methods evolve so can the level of disaggregation, which may or may not (subject to periodic monitoring) improve the functionality of the models (which also need monitoring and potential upgrading).

The overall message of this research is that, despite the virtual impossibility of developing prudent valuation methods at the individual property level, a relatively harmonised prudent value regime based on market analysis in accordance with Basel III guidance is deliverable across the EU and the UK, albeit with some variation between countries on the implementation of the prudent value framework.

REFERENCES

Adams, Z. and Füss, R. (2012). Disentangling the Short and Long-Run Effects of Occupied Stock in the Rental Adjustment Process. *Journal of Real Estate Finance and Economics*, 44 (4): 570-590.

Allen, F. and Gale, D. (1999), "Bubbles, crises, and policy", *Oxford Review of Economic Policy,* Vol. 15 Issue 3, pp 9-18.

Ambrose, B., & Nourse, H. (1993). Factors influencing capitalization rates. *Journal of Real Estate Research*, 8(2), 221-237.

Bank of England (2015*) Financial Stability Report*, December. Bank of England: London. https://www.bankofengland.co.uk/financial-stability-report/2015/december-2015

BCBS (2017) , *Basel III: Finalising post-crisis reforms*. Bank for International Settlements. https://www.bis.org/bcbs/publ/d424.pdf

Brounen, D. and Jennen, M. (2009a). Asymmetric Properties of Office Rent Adjustment. *Journal of Real Estate Finance and Economics*, 39 (3): 336-358.

Brounen, D. and Jennen, M. (2009b). Local Office Rent Dynamics: A Tale of Ten Cities. *Journal of Real Estate Finance and Economics*, 39 (4): 385-402.

Bruneau, C. and Cherfouh, S. (2015). Long-run equilibrium for the Greater Paris office market and short-run adjustments. *Journal of Property Research*, 32 (4): 301-323.

Brunnermeier, MK. and Pedersen, LH. (2009) Market Liquidity and Funding Liquidity. *The Review of Financial Studies,* Volume 22, Issue 6, pp 2201–2238,

Callendar, M., Devaney, S., Sheahan, A. and Key, T. (2007) Risk Reduction and Diversification in UK Commercial Property Portfolios, *Journal of Property Research*, 24 (4) 355-75.

Chau, K. W. and Wong, S. K. (2016). Information Asymmetry and the Rent and Vacancy Rate Dynamics in the Office Market. *Journal of Real Estate Finance and Economics*, 53 (2): 162-183.

Chervachidze, S., Costello, J. and Wheaton, W. (2009). The Secular and Cyclic Determinants of Capitalization Rates: The Role of Property Fundamentals, Macroeconomic Factors and "Structural Changes". *Journal of Portfolio Management*, 35 (5): 50-69.

Chervachidze, S. and Wheaton, W. (2013). What Determined the Great Cap Rate Compression of 2000–2007, and the Dramatic Reversal During the 2008–2009 Financial Crisis? *Journal of Real Estate Finance and Economics*, 46 (2): 208-231.

Chen, J., S. Hudson-Wilson and N. Nordby. 2004. Real Estate Pricing: Spreads & Sensibilities: Why Real Estate Pricing is Rational. *Journal of Real Estate Portfolio Management* 10: 1–22.

Crosby, N. and Devaney, S. (2019) Appraisal-based indices in MacGregor, BD., Schulz, R. and Green, RK. *Routledge Companion to Real Estate Investment*. Routledge: London and New York.

Crosby, N. and Hughes, C. (2011) The basis of valuations for secured commercial property lending in the UK. *Journal of European Real Estate Research*. Vol 4 Issue 3: pp 225 - 242.

Crosby, N. and Hordijk, A. (2021) *Approaches for Prudent Property Valuations across Europe.* https://www.rics.org/globalassets/rics-website/media/upholding-professional-standards/sector-standards/valuation/approaches-for-prudent-property-valuations-across-europe-report-2021-05-10.pdf

Crosby, N., Devaney, S., Lizieri, C. and Mansley, N. (2022) Modelling sustainable rents for estimation of long-term or fundamental values of commercial real estate, *Journal of Property Research*, 39:1, 30-55, DOI: 10.1080/09599916.2021.1913441

De Francesco, A. J. (2008). Time-Series Characteristics and Long-Run Equilibrium for Major Australian Office Markets. *Real Estate Economics*. 36 (2): 371-402.

Duca, J. V., & Ling, D. C. (2018). The other (commercial) real estate boom and bust: the effects of risk premia and regulatory capital arbitrage. *Journal of Banking & Finance*, Vol 112 (2020). https://www.sciencedirect.com/journal/journal-of-banking-and-finance/vol/112/suppl/C.

EC (2021) *Proposal for a Regulation of the European Parliament and of the Council amending Regulation (EU) No 575/2013 (the Capital Requirements Regulation or CRR).* https://ec.europa.eu/commission/presscorner/detail/en/ip_21_5401.

EMF-ECBC (2017) *Study on the Valuation of Property for Lending Purposes*. European Mortgage Federation/European Covered Bond Council: Brussels. https://hypo.org/app/uploads/sites/3/2017/09/EMF-ECBC-Study-2017-FINAL.pdf.

Englund, P., Gunnelin, Å., Hendershott, P. H. and Söderberg, B. (2008). Adjustment in Property Space Markets: Taking Long-Term Leases and Transaction Costs Seriously. *Real Estate Economics*, 36 (1): 81-109.

Eurostat (2017) *Commercial property price indicators: sources, methods and issues*. European Union. https://op.europa.eu/en/publication-detail/-/publication/22b5dd78-e539-11e7-9749-01aa75ed71a1/language-en

ESRB (2015) *Recommendation of the European Systemic Risk Board* of 15 December 2015 on the assessment of cross-border effects of and voluntary reciprocity for macroprudential policy measures (ESRB/2015/2) (2016/C 97/02).

ESRB (2016) *Recommendation of the European Systemic Risk Board of 31 October 2016 on closing real estate data gaps* (ESRB/2016/14) (2017/C 31/01). https://www.esrb.europa.eu/pub/pdf/recommendations/2016/ESRB_2016_14.en.pdf

ESRB (2022) *Review of the EU Macroprudential Framework for the Banking Sector : A Concept Note.* European Systematic Risk Board. March.

French, N. (2020) *Pricing to Market - An Investigation into the use of Comparable Evidence in Property Valuation*. TEGOVA. https://tegova.org/data/bin/a5eff013f34586_Report_on_Comparable_Evidence_in_Property_Valuation.Nick_French.June_2020.pdf

Fuerst, F. and Marcato, G. (2011), *Re-Thinking Commercial Real Estate Market Segmentation.* Available at SSRN: https://ssrn.com/abstract=1692953 or http://dx.doi.org/10.2139/ssrn.1692953

Gordon, MJ. and Shapiro, E. (1956) Capital Equipment Analysis: The Required Rate of Profit. *Management Science*, Vol. 3, No. 1, pp. 102-110

Graff, R. and Webb, J. (1997), "Agency costs and inefficiency in commercial real estate", *Journal of Real Estate Portfolio Management,* Vol. 3 Issue 1, pp 19-37.

Hendershott, P. H. (1996). Rental Adjustment and Valuation in Overbuilt Markets: Evidence from the Sydney Office Market. *Journal of Urban Economics*, 39: 51-67.

Hendershott, P. H. and MacGregor, B. D. (2005a). Investor Rationality: Evidence from U.K. Property Capitalization Rates. *Real Estate Economics*, 33 (2): 299-322.

Hendershott, P. H. and MacGregor, B. D. (2005b). Investor rationality: An analysis of NCREIF commercial property data. *The Journal of Real Estate Research*, 27(4): 445–476.

Hendershott, P. H., Jennen, M. and MacGregor, B. D. (2013). Modelling Space Market Dynamics: An Illustration Using Panel Data for US Retail. *Journal of Real Estate Finance and Economics*, 47 (4): 659-687.

Hendershott, P. H., Lizieri, C. M. and MacGregor, B. D. (2010). Asymmetric Adjustment in the City of London Office Market. *Journal of Real Estate Finance and Economics*, 41 (1): 80-101.

Hendershott, P. H., MacGregor, B. D. and Tse, R. Y. C. (2002). Estimation of the Rental Adjustment Process. *Real Estate Economics*, 30 (2): 165-183.

Hill, R. and Steurer, M. (2020) Commercial property price indices and indicators: Review and discussion of issues raised in the CPPI statistical report of Eurostat (2017). *Review of Income and Wealth,* Series 66, Number 3, 736-51.

Hoesli, M., Lizieri, C. and MacGregor, B. (1997) The Spatial Dimensions of the Investment Performance of UK Commercial Property. *Urban Studies*, Vol. 34, No. 9, 1475-94.

Ibanez, M. R. and Pennington-Cross, A. (2013). Commercial Property Rent Dynamics in U.S. Metropolitan Areas: An Examination of Office, Industrial, Flex and Retail Space. *Journal of Real Estate Finance and Economics*, 46 (2): 232-259.

ICB (2011) *Final Report Recommendations, Independent Commission for Banking,* September 2011. https://webarchive.nationalarchives.gov.uk/ukgwa/20120827143059/http://bankingcommission.independent.gov.uk///

IPF (2020) *Long-term Value Methodologies in Commercial Real Estate Lending.* Investment Property Forum: London.

Jensen, M.C. and Meckling, W. (1976), "Theory of the firm: managerial behaviour, agency cost and ownership structure", *Journal of Financial Economics*, Vol. 3 Issue 4, pp. 305-60.

JLL (2022) *Global Real Estate Transparency Index, 2022*. Jones Lang LaSalle: Chicago

Jud, D., & Winkler, D. (1995). The capitalization rate of commercial properties and market returns. *Journal of Real Estate Research*, 10(5), 509-518.

Ke, Q. and White, M. (2015). Retail rent dynamics in two Chinese cities. *Journal of Property Research,* 32(4): 324-340.

Ke, Q. and White, M. (2009). An econometric analysis of Shanghai office rents," *Journal of Property Investment & Finance*, 27(2), pages 120-139.

Lee, S. and Devaney, S. (2007) The changing importance of sector and regional factors in Real Estate returns: 1987-2002. *Journal of Property Research*, 24. pp. 55-69.Lee, 2001;

McCartney, J. (2012). Short and long-run rent adjustment in the Dublin office market. *Journal of Property Research*, 29 (3): 201-226.

Mouzakis, F. and Richards, D. (2007). Panel Data Modelling of Prime Office Rents: A Study of 12 Major European Markets. *Journal of Property Research*, 24 (1): 31-53.

MSCI (2022) *Real Estate Market Size Report 2021-2022* (https://www.msci.com/documents/10199/8f62c2a3-8374-cbf9-a7d2-a8c2c5e63e62#:~:text=information%20on%20individual%20real%20estate,investment%20portfolios%20was%20%242.5%20trillion)

PIA/CREFC Europe/IPF (2017) *Long-term Value Methodologies and Real Estate Lending.* London: Property industry Alliance/ Investment Property Forum / Commercial Real Estate Finance Council Europe. http://www.ipf.org.uk/asset/D05FA2C5-487D-4C76-997B57F3A3D72BAD/

Rachel, L., & Smith, T. D. (2015). Staff Working Paper No. 571 *Secular drivers of the global real interest rate.* Bank of England https://www.bankofengland.co.uk/working-paper/2015/secular-drivers-of-the-global-real-interest-rate.

REFG and IPF (2014). *A Vision for Real Estate Finance in the UK*. Real Estate Finance Group and Investment Property Forum.

Reid, B. (2019) Risk Reduction and Tracking Error in Small Commercial Real Estate Portfolios. *Journal of Portfolio Management.* 45 (7) 130-140.

RICS Europe (2018) *Bank lending valuations and mortgage lending value.* RICS professional standards and guidance, Europe. RICS Europe: Brussels. https://www.rics.org/globalassets/rics-website/media/upholding-professional-standards/sector-standards/valuation/bank-lending-valuations-and-mortgage-lending-value-1st-edition-rics.pdf.

Rogers, T. and Blake, N. (2013) *The Role of Commercial Property in the UK Economy*. Research Report. Investment Property Forum. https://www.ipf.org.uk/static/uploaded/bcedcb8b-56b4-43e9-8583759d5f3430ad.pdf

Sivitanides, P., Southard, J., Torto, R. G., & Wheaton, W. C. (2001). The determinants of appraisal-based capitalization rates. *Real Estate Finance*, 18(2), 27-38.

Stevenson, S. (2007) Exploring the Intra-Metropolitan Dynamics of the London Office Market, *Journal of Real Estate Portfolio Management* 13(2) 93-98. DOI:10.1080/10835547.2007.12089774

Wheaton, W. C. (1999). Real estate "cycles": some fundamentals. *Real Estate Economics*, 27(2), 209-230.

White, M. and Ke, Q. (2014). Investigating the dynamics of, and interactions between, Shanghai office submarkets. *Journal of Property Research*, 31 (1): 26-44.