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Investment decision-making under economic policy uncertainty

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Abstract

It is widely established that economic policy uncertainty (EPU) affects investment decisions and performance, yet research in this area has overlooked the direct property investment market. This paper seeks to rectify this and proposes a multi-stage multi-level analytical framework to offer new insights and a richness of findings. Using a news-based measure of EPU in the UK, and controlling for economic conditions, a national level analysis reveals some evidence of Granger Causality between EPU and total returns, indicating that pricing is responsive to uncertainty. These findings suggest that EPU is an important risk factor for direct property investments, with pricing implications. Differences in data and performance measure are important, however, with income returns unresponsive. A micro-level investigation begins to reveal some of the asset-pricing decisions underpinning the national results, indicating investors' concerns for income streams are consistently high, regardless of varying EPU. Pricing can also cause changes in EPU, such as in the retail and industrial markets (increasingly linked through logistics) reflecting sector-specific stakeholder groups and newsworthy issues. This evidence highlights how important it is for policy-makers to understand the complex and bi-directional relationship, that indecision can undermine investment confidence and cause investment market volatility, in turn raising EPU.

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Investment decision-making under economic policy uncertainty

1.0 Introduction

Economic Policy Uncertainty (EPU) relates to uncertainty in the fiscal, regulatory and monetary framework of a country that can be generated by an unexpected policy shift, surprise election outcome or ambiguity stemming from the emergence of a major political debate. It is a class of economic risk where the future path of government policy on monetary or fiscal issues, taxation, expenditure or regulatory regime is ambiguous and unpredictable and, like other sources of risk and uncertainty, can generate volatility in economic and financial systems as market agents adapt their expectations and behaviours. The small, but growing body of evidence on the effects of EPU shows that sudden and significant shocks to economic and political policy lead to fluctuations in economic activity and disturbances which are felt directly within the general economy and across financial markets. The majority of this evidence has focused on the impacts on the behaviour of firms and, more widely, on economic activity at the aggregated level (for example, Hassett and Metcalf, 1999; Fernández-Villaverde et al., 2015) with only a small number of studies looking at effects within the financial sector.

Pastor and Veronesi (2013) highlight the absence of mainstream finance literature investigating asset price effects, and explore illustrative examples, such as Standard & Poor's downgrading of the US credit rating due to a rise in political uncertainty. Through this they develop a general equilibrium model to examine the impact of EPU on stock prices, and find evidence that stock prices are responsive to political news and heightened uncertainty around government policy direction that can lead to greater asset price volatility that cannot be fully explained by economic conditions alone. Additionally, they find higher correlations in stock prices during periods of higher EPU, supporting the argument that uncertainty stemming from the economic policy of governments tends to be universal across investment markets and results in market-wide, non-diversifiable effects which raise the total risk carried by nation-bounded investment portfolios (Brogaard and Detzel, 2015).

Property investors make decisions based on their expectations of how assets will perform within the future economic policy environment. Uncertainty will always exist regarding the predictability of the future but heightened uncertainty around a country's future institutional framework can lead to a rise in risk premia, which in turn impacts directly on the pricing of assets and investment decisions (Brogaard and Detzel, 2015). Yet, the direct property investment market has largely been over-looked in the EPU literature with only a small number of published studies looking at how house prices respond to political news. An understanding of this market is essential to all stakeholders involved, especially fund managers who can better hedge the effects of price volatility on their funds, and those with policy responsibilities as resultant investment market shocks may impact upon economic stability.

This study aims to fill this gap by examining whether, and how, the commercial property investment market and, further, investment decision-making, varies in times of uncertainty. The study focuses on the office, retail, industrial, leisure and hotel sectors, the largest part of the UK commercial property investment market, and uncertainty as measured by EPU data. Subsequently, the objectives of the paper are two-fold: i) to examine the relationship between commercial investment property returns and EPU; and ii) to investigate the behaviour of property investors when making stock selection decisions under different levels of EPU. By combining these two areas of investigation, the study is, first, able to test for the existence of any significant relationships between sector level investment returns and uncertainty, important for meta-level decision-making and policy responses. However, it is argued that a more granular investigation is also needed to truly explore the pricing relationships and reveal how different investment attributes are perceived under different levels of EPU. Thus, the second area of investigation focuses on an in-depth exploration to further unpick the complex relationship between EPU and returns by examining preferences for the array of investment attributes that underlie pricing decisions.

The work is of significance as the effects of EPU on commercial property investment activity have largely been ignored until now, despite the recognised potential of volatile property prices and returns to contribute to a destabilised economy. Hence, exploring and understanding the complexities of causation across and between uncertainty, behaviour and pricing is essential, to illuminate practices and thus enable the optimisation of market and policy responses. This paper is novel in that it combines macro- and micro-level approaches to investigate the investment decision-making process, drawing on the real estate pricing framework proposed by Crosby et al. (2016) which explicitly identifies these two levels of factors as important. Firstly, the paper, based on the aggregate level approaches in other work, tests the complexities of causation between changes in economic policy uncertainty and changes in asset returns. The tests are undertaken over time and across sectors, and reveal that two-way Granger-Causality exists between commercial property returns and EPU, although the relationships are complex and subject to differences in the occupier and investor markets across sectors. Data characteristics are also important. Subsequently, the second stage, at a highly granular micro-level, uses unique primary behavioural data to explore individual real estate investment decisions and, specifically, whether investors seek the same asset characteristics in different EPU contexts. This reveals that some attributes remain critical to investors, regardless of uncertainty, with income security prioritised regardless of EPU changes. It also highlights some differences between distinct EPU regimes, indicating not just that investor behaviour responds to uncertainty, but the results reveal what those differences are. Furthermore, the findings show that behaviours vary across decision-makers operating within the same time period, but who have different economic outlooks.

Through this unique combination of aggregated and granular investigations, the complexity (and diversity) of the relationships between policy uncertainty and investment returns is revealed and investor behaviour explicitly learned.

2.0 The impact of uncertainty on investment markets

In economics, uncertainty is differentiated from risk (Knight, 1921). In accordance with Knight, Bywater (2011) defined risk to be the probability that an expected cashflow (or required rate of return) will be achieved, while uncertainty arises from a lack of knowledge and information, and cannot be quantified. Hence, the information necessary to develop an optimal investment decision under complete uncertainty does not exist, as the unknown probability distribution means the effects cannot be modelled or subject to a rational decision-making process. Investors behaving with rationality who employ a decision-making process based on past experiences and theoretical knowledge is a fundamental premise underpinning neoclassical economics. The counter position of this logic is that when the future is uncertain and there is insufficient information to guide investors, then investors investing under such conditions display irrational behaviour such as the herd-like flight to quality common after an unusual investment market event (Caballero and Krishnamurthy, 2008; Baltatescu, 2015).

However, investors must still make decisions under uncertainty and investments will always contain an element of uncertainty. The level of uncertainty will vary and Hargitay and Yu (1993) categorised this as a “spectrum of uncertainty” where the lowest level of uncertainty is absolute certainty and represents risk-free cashflows. The highest level of risk to cashflows is absolute uncertainty, which is unmeasurable and aligns with what economists call Knightian Uncertainty.

Pastor and Veronesi (2012) differentiate between types, or causes of uncertainty, such as political uncertainty (whether current government policy will change) and impact uncertainty (what the impact of a new government policy will be). There is also general economic uncertainty, with the effects being defined as the political costs associated with the implementation of different policies, and arise as “posterior beliefs about the old policy's impact are replaced by the prior beliefs about the new policy's impact” (Pástor and Veronesi, 2013, p. 521). Uncertainty in general, and EPU in particular here, is, thus, an important consideration for investors, with Barker et al. (2016) discussing how it can generate share price volatility and affect levels of production investment activity.

Investors and business occupiers, particularly those that are sensitive to policy shifts, become nervous about a changing economic outlook, especially if some of the policy changes are perceived as potentially reversible. This encourages behaviour, which Rodrik (1991) describes as typical rational behaviour, such as delaying spending, investing and expanding activities until the elimination of much of the residual uncertainty after the policy change. The delay in private investment triggered by the elevated policy uncertainty can be severe enough to dampen the growth of the investment market and stall economic growth. Rodrick (1991) reports that, in addition to individual and firm level effects, wider adverse impacts may be felt on levels of imports/exports, exchange rates, savings and even socio-political stability.

The lengthier, more contentious or erratic the policy process then the greater the uncertainty and its effects (Friedman, 1968; Bloom, 2009). Investors and business occupiers receive continuous streams of news, but policy-news shocks can generate greater variation in uncertainty as these policy changes, motivated by a complex array of factors, are not necessarily certain to take place at the time of announcement. Typically, the response to government policy news is immediate and relatively short in duration, described by Bloom (2009) as the result of the first moment shock which could possibly explain the insignificant effects on business cycle fluctuations found by Born and Pfeifer (2014). Yet, further temporary volatility can occur in the wake of political indecision and the uncertainty that emerges as a result. This forces businesses and individuals to reset their expectations again, leading to further economic shocks (Brogaard and Detzel, 2015). These second moment shocks have been particularly evident in the wake of the Global Financial Crisis in 2008/09, as shifts in economic policy became commonplace as policy-makers responded to sequential crises and subsequent preventative measures. These events, and the resultant geopolitical restructuring that has taken place as a consequence of the political jockeying and debates, have continued to drive uncertainty within the global economy.

Brogaard and Detzel (2015) found that ambiguity around economic policy leads to economic effects on investment markets that increase the systematic risks faced by investors. Using an intertemporal Capital Asset Pricing Model to investigate excess returns, they found a negative correlation between changes in EPU and stock market returns and, further, estimated that economic policy indecisiveness, as measured by a one standard deviation increase in reported levels of EPU, was associated with a 6.12% fall in annualised returns. They also found modest evidence of a positive relationship between current levels of EPU and short term forecast market excess returns, arguing that it is possible for fund managers to structure their portfolios to hedge against rises in EPU. While Brogaard and Detzel find that investors are willing to accept lower returns on assets that protect against rising levels of EPU, Pástor and Veronesi (2013) take it a step further and find that this premium effect on stock market prices is dependent on wider economic conditions. In their model of government policy choice they estimate that change in political policy tends to produce a relatively higher risk premium in weaker economic conditions, concluding that this occurs because it is during periods of economic contraction that governments are more likely to make policy adjustments.

When there is increasing EPU, private sector firms and individuals are reluctant to invest, contributing to delayed economic activity. Theory might suggest that increased EPU will have a similar effect on property investment decisions. Sum and Brown (2013) suggest that reluctance to expand business operations due to rising EPU will have a negative impact on occupational demand and rental growth. Lower rental growth expectations impact directly on investment yields, possibly impacting on the willingness of investors to spend on specific assets. Some threatened policy changes may even signal potential falls in net income cashflows, as the resultant policies would give rise to higher administrative and regulatory costs, or may reduce the legal protection that the current institutional framework provides for investors in the UK. Lieser and Groh (2014), modelling the transparency of the legal framework, found the political environment to be one of the key selection criteria used by international property investors to gauge the attractiveness of a real estate market. Other studies (for example, Quigley, 1999) have found that households and firms have adaptive expectations and, while their expectation adjustments may seemingly be in a rational manner, uncertainty and sudden change in government policy are known to influence their property investment decisions.

Like Quigley's (1999) study, Antonakakis et al. (2015) studied the housing sector and found links between EPU and the housing market. They modelled the movements in US housing returns with EPU, and found that high levels of EPU, particularly in the period after the recent financial crisis, had a negative impact on house prices, over and above the effects of changes in financial and economic conditions. However, they also found that this was a bi-directional process, with falls in house prices leading to a rise in EPU as potential government responses to a slump in the housing market were debated. Aye (2017) also argued there is a bi-directional relationship between EPU and house prices. As yet no studies have examined the linkages between policy uncertainty and direct commercial property returns or purchasing decisions, with the only commercial market study investigating property share returns. Here, Sum and Brown (2013), using US REIT and EPU monthly indices spanning 1985-2011 in a series of time-varying regressions, found EPU to negatively affect equity and mortgage REIT returns.

D'Arcy and Keogh (1999) argue that the performance of a national property market is defined by its sociocultural and political environments, and that government policy risk is a key factor in international investors seeking diversification. Bewley (1986) also theorised that Knightian Uncertainty could result in under-diversification by individual investors. Walden (2004) modelled venture capitalists and found that they tended to hedge against high uncertainty but, if they were unable to hedge, and if the potential political decisions were perceived as irreversible, investment would stall and, when resumed, lead to higher hurdle rates. Similarly in the real estate sector, evidence exists that political instability, as well as corruption and a lack of market transparency, deters flows of foreign capital into a country (Hine, 2001; Jones Lang LaSalle, 2008). It is also well established, for example using real option pricing models, that, in the development sector new developments and redevelopments will be postponed as uncertainty increases (be that general uncertainty or EPU) (Grenadier, 1996).

Property investments lie between the two extremes on the "spectrum of uncertainty", and pricing and managing the consequent risk is central to the task of the investor. Understanding where an individual investment lies on this spectrum underpins property investment strategies and decisions. The asset acquisition decision was explored by Jackson and Orr (2011), whereby primary data were generated from fund managers engaging in a stock selection simulation exercise, controlling for respondents' stated expectations of economic and market movements. The results indicate that these expectations, or perceptions, do impact on micro-level investment decisions. As the forming of perceptions is underpinned by uncertainty, these results suggest that the level of EPU will impact on investment (and management) decisions. Dhar and Goetzmann (2006) conclude that a consequence of uncertainty in the investment decision-making process could be the deviation of asset prices from their market worth, and "can cause risk-taking behaviour to appear irrational when measured against the classical framework" (Dhar and Goetzmann, 2006, p. 109). This conclusion concurs with the findings of Clayton et al. (2009) and Ling et al. (2014) who find that investor sentiment, defined as the general prevailing attitude of investors, can cause over-valuation and persistent mispricing in the direct real estate market. While market sentiment is the product of a variety of fundamental and technical factors, EPU is a component that has a direct impact on the confidence and psychology of the market, which in turn could constrain the ability of the market to arbitrage away pricing differentials and contribute to sentiment-induced mispricing (Ling et al., 2014).

To provide a framework within which investment decision-making under uncertainty can be explored, the pricing of investments is crucial. The pricing of individual real estate assets follows the pricing model of Fisher (1930) and Gordon (1959) with, in some texts, an extension to include depreciation. More recently, some work has begun to explicitly unravel the components of the risk premium within the traditional model, for the real estate sector. Crosby et al. (2016) identify and categorise its components, proposing that, at the highest level, the model may be refined for the real estate asset to give:

$$k = RFR + RP_{REM} + RP_{STK} \tag{1}$$

where k represents the expected return, RFR is the nominal risk-free rate, RP_{REM} is the part of the risk premium attached to the real estate market (systematic risk) and RP_{STK} is the part of the risk premium attached to property-specific attributes (unique risk), with the pricing of those attributes also reflecting growth expectations and depreciation. Pricing of these two components of the risk premium reflects their risk and will be undertaken within the particular regime of uncertainty that exists, or is perceived to exist, at any given moment in time. Crosby et al. suggest that each of these two elements are comprised of a further series of components, such that RP_{REM}, comprises RP_{mkt} (real estate market risk), RP_{sct} (real estate sector risk) and RP_{locm} (real estate market location risk); with RP_{STK} comprising RP_{ten} (tenant risk), RP_{lse} (leasing risk factors), RP_{locs} (stock location risk) and RP_{bld} (building risk), to give rise to a final refinement to the pricing model of:

$$k = RFR + (RP_{mkt} + RP_{sct} + RP_{locm}) + (RP_{ten} + RP_{lse} + RP_{locs} + RP_{bld}) \tag{2}$$

Within real estate research and thus knowledge there is a considerable void regarding pricing and behaviour under uncertainty. Furthermore, the recognition that such pricing comprises a series of elements, as set out by Crosby et al., relating not just to macro-level property market factors, but to micro-level asset-specific factors, remains overlooked.

This paper aims to address this gap in property investment knowledge. Corresponding to the study's two research objectives, and reflective of the pricing model in Equation 1 which forms the overarching framework for the empirical section, a mixed methods multi-level approach is adopted. In the first of two stages, a macro-level examination is undertaken at the national level to look at the relationship between EPU and commercial property returns movements over time. This explores whether volatility in returns (as a function of pricing) is responsive to EPU, reflecting the systematic risk element of Equation 1 and underlying supposition that national level data are indicative of a market portfolio where stock-specific factors are diversified away. In the second stage, a micro-level investigation is undertaken at the individual asset level, to examine whether and how investor pricing behaviour responds to EPU, with respect to stock-specific attributes, the unique risk component in Equation 1. This highly disaggregated stage further explores and extends the work of Jackson and Orr (2011) and enables investigation and enhanced understanding of investors' behaviour under two contrasting EPU regimes – one period where EPU was low and relatively stable, and another when EPU was much higher. This helps to reveal and understand the factors underpinning the findings in the first stage. Thus, this paper argues that, to truly explore behaviour and pricing in the real estate market, there needs to be explicit recognition of these individual, but related, components. As set out in detail below, together these two stages explore relationships between uncertainty related to economic policy, returns and behaviour in a new and robust way. The methods and sampling are discussed over the next two sections.

3.0 Macro-Level Stage - interaction between EPU and commercial property in the UK

3.1 Methods and data

In line with the first objective of this paper, to examine the relationship between commercial property returns and EPU, this section sets out the analytical framework and then the data used. A Granger Causality model is developed as an initial stage in investigating, not just whether real estate market returns respond to changes in EPU, but the wider complexities of the relationship over time, reflecting its importance to economic stability. Granger-Causality is a form of statistical hypothesis test that has become an established technique in economics to probe the causal-effects between two variables, and is widely used to investigate the effects of EPU, although not previously in the commercial property sector. The specification of the linear bi-variate vector autoregression (VAR) model is:

$$\Delta R_t = \alpha_0 + \sum_{i=0}^{n} \alpha_i \Delta\, EPU_{t-i} + \sum_{i=0}^{n} \beta_i\, \Delta R_{t-i} + \mu_t \tag{3}$$

$$\Delta EPU_t = \gamma_0 + \sum_{i=0}^{n} \gamma_i \Delta\, R_{t-i} + \sum_{i=0}^{n} \delta_i\, \Delta EPU_{t-i} + \varepsilon_t \tag{4}$$

where ΔEPU refers to the differenced measure for economic policy uncertainty, ΔR is the differenced property returns series and μ_t and ε_t are the error terms[1]. Granger-Causality does not necessarily measure true causality, particularly between aggregated variables, and can lead to misleading results if it does not capture the effects of other factors, such as economic conditions. Subsequently, therefore, the Granger-Causality model is extended to include an indicator variable ($Econ_t$):

$$\Delta R_t = \alpha_0 + \sum_{i=0}^{n} \alpha_i \Delta\, EPU_{t-i} + \sum_{i=0}^{n} \beta_i\, \Delta R_{t-i} + \theta Econ_t + \mu_t \tag{5}$$

$$\Delta EPU_t = \gamma_0 + \sum_{i=0}^{n} \gamma_i \Delta\, R_{t-i} + \sum_{i=0}^{n} \delta_i\, \Delta EPU_{t-i} + \vartheta Econ_t + \varepsilon_t \tag{6}$$

$Econ_t$, similar to the approach employed by Fuerst and Grandy (2012) whereby the effects of property cycle contractions were included in their development activity VAR model, is specified here as a dichotomous exogenous variable to identify contractions and expansions in the economy, and control for their potential impact on property returns and EPU[2].

The EPU data used to estimate Equations 3-6 are published on-line by Baker, Bloom and Davis as an index of policy uncertainty in the UK, which measures the frequency of economic policy-related uncertainty news items within The Times of London and Financial Times. The Baker, Bloom and Davis measure allows for the continuous tracking of policy uncertainty over the study period, as shown in Figure 1. This graph plots the monthly Economic Policy Uncertainty Index between 1997 and 2017, and illustrates how major changes in EPU volatility in UK can be linked to key political events. Additionally, the time points in shade in Figure 1 represent recessionary conditions and the white blocks represent periods of economic expansion, as defined by the OEDC's Turning Points and Component Series data series (OEDC, 2018), and used in the model as the variable $Econ_t$. Visually, as an overview, this indicates that variations in EPU do, at times, seem to coincide with economic fluctuations but, interesting, this relationship is not consistent. There are higher levels of EPU in the first, second, fourth and fifth periods of recession (shaded time periods), but the higher levels of EPU linked with the Treaty and Accession/Gulf War II and around the later Eurozone Crisis are clearly in times of economic expansion, as indicated in Figure 1.

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[1] Johansen cointegration trace and Max-eigenvalue tests indicated no cointegration at the 0.05 level, implying that it was suitable to employ a VAR modelling framework for the differenced data.

[2] The dummy $Econ_t$ variable enabled time points when the market was contracting to be categorised and avoided potential orthogonal matrix issues associated with the inclusion of EPU and a continuous variable measuring economic conditions.

[Insert Figure 1]

Four types of investment return measures are modelled in Equations 3-6. The first three are the long-standing MSCI indices derived from valuation-based data, which seek to track transaction prices (MSCI, 2018): the MSCI total return index; MSCI capital growth index; and MSCI rental return index. The fourth is a more recently available MSCI index for the UK, which uses transaction-linked data. These data presently are more limited in coverage, in terms of sector, performance measure (being limited to capital value growth rates) and a slightly shorter time-series. They are included, however, to provide a useful comparison, not only to the results from the MSCI valuation-based indices used here and which dominate UK-based studies, but also to any future international studies where transaction-based data may be more widely available. All the time-series data have been deflated; and the valuation-based indices desmoothed, using the regime-switching autoregressive (TAR) method recently developed by Lizieri et al. (2012)[3]. This adjustment to the returns generating process allowed for the desmoothing parameter to vary over time as regime conditions change. In this paper 3-month LIBOR rates were employed for all-property, office and hotel returns while FT returns, in logs, were used to determine the regime parameters for the other returns[4]. The estimates of Equations 3-6 have also been undertaken using the raw data that have not been desmoothed.

The use of these data is based on the supposition that, predominantly, they reflect the pricing of real estate market factors, as set out in section 2, with the highly granular nature of stock-specific factors diversified away at the aggregate level. It is appropriate, however, to acknowledge that, as set out in Equation 2, RP_{REM}, exposure to the real estate market is a category comprising market, sector and locational risks. With respect to the first one, the data do, of course, reflect performance and volatility of the UK's real estate market; and with respect to the second, the analysis has been undertaken not just for all real estate, but by sector, to explore for any variations in the relationship between EPU and each commercial sector. This analysis is at the aggregated national level so does not explore locational variations, as to define coherent and distinct locations, based on underlying market fundamentals, is a study in itself and outside of the current focus.

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[3] Lizieri et al. (2012) found that their TAR-TAR model outperformed conventional AR smoothing techniques which underestimate the variance of the true underlying series. However, for fullness and comparison, the valuation-based indices have also been desmoothed using the first order autoregressive (AR(1)) process proposed by Geltner (1993). For conciseness of presentation, the results using the AR desmoothed data are shown in the appendix. The results are highly similar, although it is interesting to note that, where there are differences, the results using the AR smoothing technique are consistent with the results obtained using the raw data.

[4] Selection of these regime determinants was based on the minimisation of the sum of errors and Aikake Information Criterion as advised in Lizieri et al. (2012).

The statistical properties of time series data are another important consideration in devising a suitable modelling framework. Table 1 reports the ADF statistics for EPU and for the first three measures of real property performance (both overall and for each sector), deflated using the TAR-TAR method, when the lag length is selected by minimising the Schwarz Information Criterion. The tests reveal that the data series in levels contain unit roots but are stationary (I(0)) when differenced[5]. The ADF statistics for EPU and the transaction-linked index are shown in the appendix, in Table A3.a. The null hypothesis testing *ΔEPU* Granger-Cause *ΔR* (Equations 3 and 5) and *ΔR* Granger-Cause *ΔEPU* (Equations 4 and 6) is then undertaken using the stationary data and chi-square testing. The optimal lag length (underpinning the results presented in Tables 2 and A3.b, the latter in the appendix) selection selected for the *ΔEPU* and *ΔR* variables in the VAR model is determined by the Aikake Information Criterion.

[Insert Table 1]

3.2 Findings

The results obtained from the estimation of Equations 5 and 6 are fully aligned with and confirm the results for the initial model represented by Equations 3 and 4. Therefore, the results derived from the VAR model specified by Equations 5 and 6, being more sophisticated, form the focus of the discussion here. The results derived using the valuation-based data are shown in Table 2. The supplementary results, firstly using the more limited coverage provided by the transaction-linked data and, secondly, the raw data, are shown in the appendices for conciseness of presentation. For the main results, as set out in Table 2, focusing initially on the aggregated all-property data, there is a bi-directional relationship between total returns and EPU and capital growth and EPU, but there appears to be no relationship between income return and EPU. Breaking down these findings to explore for sectoral variations, the results from Equation 5 suggest the influence of EPU on property total returns is sector dependent. In more detail and focusing on the three main sectors, there is evidence that changes in EPU Granger-Cause total returns in the office sector. The data for the office sector are heavily dominated by the London markets, which tend to have greater exposure to international investors and occupiers than other sectors (Mitchell, 2016), who may be highly sensitive and responsive to relative national changes in EPU.

The results for the industrial sector are different. There are increasingly diverse occupiers in this sector where manufacturing output is sensitive to exchange rate movements and previous studies have shown that shifts in levels of EPU can drive exchange rate movements (for example, Balcilar et al., 2016). Manufacturing, alongside the expanding logistics sector, drives occupation demand in the industrial sector and, as Baker et al. (2016) identified, production is susceptible to uncertainty so you would expect the effects of EPU on output and distribution to impact on investors' perceptions of default risk and/or reduce rental growth prospects. However, this is not the case where the results suggest EPU does not Granger-Cause total returns. These results are mirrored in the retail sector, which is largely (although not exclusively) driven by domestic consumer spending and behaviour, and dominated by UK retailers. This is, perhaps, surprising in the retail sector as, with the economic uncertainty and lack of growth in the decade after 2007 leading to austerity measures and the consequent impact on consumer spending, one might have expected to detect clearer evidence of the responsiveness in property returns to changes in EPU. It may be that unsecured credit, which has typically driven consumer spending and uncontrolled surges in lending, both prior to 2008 and the renewed escalation in household debt since 2014, may be masking the effects of rising EPU (Bank of England, 2018). However, this is not revealed from the desmoothed data in Table 2, although it is supported by the results found using raw valuation-based data (See Table A2 in the Appendix).

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[5] In the case of retail income returns, they had to be second differenced before becoming stationary.

Exploring other measures of return, there is no evidence that changes in EPU Granger-Cause income return in any of the main sectors. This lack of causality is consistent with the leasing structure in the UK, where rents are most commonly fixed for a period of say 3-5 years. With respect to capital growth, as presented in Table 2, only in the office sector is there evidence that changes in EPU Granger-Cause changes in capital growth (and this is consistent with the results from both the raw and transaction-linked data sets, as shown in the appendices). Examining the results when the estimations are repeated using the transaction-linked data, shown in Table A3.b in the appendices, notably the significant unidirectional relationship between EPU and capital growth for all three sectors suggests that pricing in the market is more sensitive to EPU than is being picked up by the appraisal data.

Examining the other sectors, the hotel and leisure sectors (when disaggregated from the “Other Property” category) show no interactions between EPU and any measure of returns for Equation 5. These are growth sectors in the UK property investment market where demand for these types of accommodation is driven by a multitude of factors. Many frequent users of hotels do so for essential business purposes and are more likely to change hotel specification rather than not travel. Occasional users consist of international tourists who travel to satisfy personal choice and would not typically be influenced by UK politics or policy, notwithstanding any shift in behaviour in the final 18 months of the data series, following the Brexit referendum.

In contrast to the sector-dependency detected in the results of the estimations of Equation 5, the results from Equation 6 suggest that changes in total returns in all three main sectors drive EPU. The direction of this relationship appears to indicate that policy debates arise as a result of changes in the real estate sector, with those policy debates in turn having the potential to generate uncertainty that can cause volatility in economic and financial systems. It may be suggested that changes in investment performance indicators, especially those that are relatable in news coverage such as the affordability of rental levels and business viability, alongside shifts in consumer behaviour and changes in other macro-economic variables, can drive policy debates over taxation, wage negotiations and other fiscal changes. One example is the often high profile debates around changes in the retail sector, the impacts of which on the high street are highly visible to wider stakeholder groups. This direction of causation may be particularly notable following a financial crisis and, certainly, following the most recent crisis, there were widely reported debates and attempts to derisk and delever the property investment market through changes to banking regulations and other changes in Stamp Duty Land Tax and business rates. These assertions are further supported in the findings of Antonakakis and Floros (2016), who examined the interdependencies between the macro-economy and housing market, stock market and policy uncertainty, and found evidence of two-way effects from the asset markets to industrial production growth, inflation and interest rates, which in turn have corresponding spillover effects that impact on EPU. It may be that such contemporaneous feedback mechanisms also exist for the commercial property sectors, which also impact on default rates and, therefore, investment yields, and can give rise to increased EPU as policy-makers debate how best to manage and support these sectors in the context of highly visible vacancy rates in urban areas.

In terms of other measures of investment performance, only in the retail (and aggregate "Other Property") sector do income returns appear to have significant causality driving EPU levels for the results. Only in the office sector, do changes in capital growth drive EPU (with no relationship evident from the transaction-linked data). These findings further reflect the unique (newsworthy) factors in the occupier market in the retail sector and investor market in the office sector, as explored above, and their importance to economic growth and, hence policy debate.

This first stage of the study has provided insights into the complexities of the relationships between commercial investment property returns and EPU. At the highest level of aggregation, for all property, as set out in Table 2, total returns are seen to change in response to changing uncertainty and this is most strongly confirmed in the office sector. The retail and industrial sectors, however, perhaps surprisingly, appear different. Over the longer term, consumer spending, the holy grail in the investor market of the retail sector (and the expanding logistics sector of the industrial market), has been comparatively resilient. Rising vacancy rates in the retail sector in more recent years are linked to business factors and consumer behaviour, rather than economic policy uncertainty; yet those vacancies themselves are highly visible in the news and shown to trigger policy debates and uncertainty. Finally, and interestingly, the results shown for comparison in the appendices suggest that transaction-linked capital returns are more sensitive to EPU than the appraisal data in Table 2 suggest. These results add valuable knowledge to this area, which has largely been overlooked in previous studies. However, a disaggregated approach is needed to truly explore the drivers underlying the results and, thus, provide new insights into the effects of uncertainty on the actual decision-making of investors. Therefore, to do this, the second stage of the study focuses on investigating investment decision-making at the micro-level to see if, and how, behaviour and, specifically, the purchase preferences underlying pricing decisions differ across contrasting period of EPU.

[Insert Table 2]

[Insert Table 3]

4.0 Micro-Level Stage - stock acquisition under different EPU regimes

4.1 Methods and data

This second stage of the study seeks to gain insights into the second component of the real estate risk premium framework (Equation 1), the pricing of unique risk at the asset level and how it changes under different EPU regimes. This requires the collection and analysis of primary data from individual active investment agents, to assess behaviour and investment preferences. This was undertaken at two contrasting points in time, as shown in Figure 2. The first was in Q2 2007, a period of low and fairly stable EPU, before the collapse of the Northern Rock bank in the UK which was the first major signal of the subsequent credit restrictions and the consequent liquidity crisis.[6]

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[6] However, a shift in credit risk perceptions in the general economy was evident during this study period as the TED spread had started to rise in April/May.

The survey was repeated almost a decade later in Q2 2016 under different EPU conditions. The survey was completed just before the vote in the UK Brexit Referendum and, as seen in Figure 2, EPU was much higher and less stable.

[Insert Figure 2]

The survey collected data on investors' purchasing decision-making at the stock selection stage, within the explicit context of their expectations of market movements. Expectations of market movements were captured through their stated views of both rental movements (to reflect income return potential and risk) and yield movements (to reflect capital and total return risk). The data were captured through a conjoint survey that required investors to make a series of investment acquisition decisions, the choices presented being designed to simulate the complexities of a real world investment situation. This is important because it allows us to see whether, and how, investor behaviour and preferences for real estate asset attributes differ under contrasting EPU regimes, while controlling for different economic outlooks. The surveys focused on replicating the forward-looking nature of the decision-making process, through simulating the complex investment characteristics of real estate stock, and this is novel and also important in a study of uncertainty. Situating this within the actual market and economic contexts that respondents were working under provides compelling and grounded evidence of their perceptions and behaviour under different EPU regimes.

4.1.1 *CBC survey design*

Choice Based Conjoint (CBC) surveys were undertaken in 2007 and 2016. The two surveys used almost identical ways of presenting and completing the CBC survey, the first survey period involved the researchers visiting the respondents in person with the survey on a laptop (with additional contextual data collected through a short interview); whereas the second survey was administered on-line, including both the CBC survey and collection of contextual data.[7] The CBC survey method can help examine the process by which a purchasing decision is made when an investor is faced with making a choice between alternative investment opportunities, each comprising a combination of different attributes. These attributes align with the pricing model presented in Equation 2.

Eight attributes were employed in the surveys (drawing from the conceptual framework and attribute definitions established by Jackson and Orr, 2008; 2011), with refinement made to the attribute levels in the second period to reflect updates over the decade. These are summarised in Table 3, with adjustments highlighted in italics.

[Insert Table 3]

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[7] Software developments allowed the CBC questionnaire to be delivered online and this gave rise to some possible differences in completions. By using an online tool, it was possible for the respondents to start but not complete the survey, whereas this was encountered only once in the first period. In both survey periods, respondents worked through the tasks alone, although in 2006 the researcher was in the room. By contrast, in 2016, the respondents may have rushed or, indeed, have taken greater care when completing the survey. No obvious patterns were found when interview and question completion times were reviewed across the respondents of both surveys.

The CBC survey involved presenting each respondent with twenty randomised choice-based investment acquisition tasks consisting of different assets characterised by different combinations of attribute levels. Each task contained three investment options, with clear instructions to select one of two assets for purchase or, a third choice, of selecting neither. The choice was based on the assumption that the assets and their attributes were correctly priced. The randomised design of the survey, with balanced overlap, while widely regarded as slightly less efficient than a fixed orthogonal design plan, is preferred as it has the offsetting advantage of being easy to implement and is robust in character (Mulhern, 1999; Chrzan and Orme, 2000). Although prohibitions reduce the efficiency of a CBC design, six two-way prohibitions were included in the 2016 survey between some of the location, BREEAM and economic and functional obsolescence levels to avoid illogical combinations in the light of the revised BREEAM levels.

4.1.2 *Survey sample*

A purposive sampling approach was adopted, with survey participants selected for their involvement in property fund management. The selection criteria also required their fund to be UK-based to ensure the relevance of the specified property attributes, and their exposure to UK specific economic and EPU conditions. In both cases the sample was constructed from online sources such as the UK Property Investors Directory (Data, 2004), EGi Who's Who listing service, LinkedIn, the Investment Property Forum membership database (the authors are members), company websites, Trustnet, and AREF. The starting point for the development of the 2016 database was the sample of respondents in the previous survey although 30% of those respondents could not be included, variously due to leaving the industry or the UK, moving out of fund management, or because they simply could not be traced. While it is not assumed that the sample comprises the entire population of property fund managers, towards the end of the process of developing the sample, each new data source yielded fewer and fewer new additions[8].

Table 4 provides a comparison of the respondents at the two survey points. This shows that the gender and skills breakdown of the samples are broadly similar. One noticeable difference is that there are not as many 2016 respondents with over ten years of experience in their current role. This implies that the 2016 sample may be younger and less experienced but 88% of the sample has over ten years of experience in the property industry overall.

Table 4 also shows the breakdown of the 336 industry participants targeted in the 2016 sample, where data are available. The data reveal that the characteristics of the respondents align with the overall sample, really quite closely. The gender breakdown of respondents is very closely aligned and, for the current position, there are slightly fewer respondents at Director level, balanced against marginally higher proportions in all other categories. This implies that the profile of respondents is closely matched to the wider population of fund managers, with no obvious reason to suspect response rate bias.

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[8] In 2007 the sample was developed and contacted in two stages, increasing the number of respondents iteratively, until resources were exhausted and sufficient responses achieved. In 2016, due to the use of the online survey method of data collection, a larger sample was needed and thus in total a sample of 377 was drawn, giving an achieved sample of 336 after allowing for fund managers moving company, funds or position, on maternity/paternity leave and erroneous contact details. From this, a response rate of 15.5% was achieved.

[Insert Table 4]

The respondents’ expectations for the property market and the economy are categorised in Table 5 and reveal mixed expectations at both survey points, although there is more positivity in the earlier period and more negativity and uncertainty in the second period. In the second period, six respondents placed a caveat on their responses with respect to the forthcoming UK Brexit referendum vote, evidencing the level of uncertainty in the market.

[Insert Table 5]

4.1.3 *CBC estimation methods*

The CBC conjoint survey enables the collection of discrete choice data and estimation of the relative importance respondents place on each attribute and attribute levels as measures of utility (part-worths) (Sawtooth Software, 2013). The relative size of these utility measures provides a gauge of the relative importance placed on an attribute and level. The higher the part-worth utility then the more desirable that attribute is perceived.

The utilities can be estimated in a number of ways but the most sophisticated method is the Hierarchical Bayes (HB) estimation method (Sawtooth Software, 2009a). The results reported in this paper[9] are based on the HB estimation approach because it enables the robust analysis of individual respondents, and can be used to aggregate individual respondents into homogenous *a priori* groupings, here the groupings being expectations with respect to market movement.

The HB estimation procedure is based on Bayesian methods that are used to estimate the parameters of a randomized coefficients regression model. It is called hierarchical because it consists of two levels. At the top level, all the respondents are considered to be members of a population of similar individuals, and averaged part-worth utilities, means and variances are calculated as a multivariate normal distribution[10] across the entire sample (Sawtooth Software, 2009a). The bottom level calculates the part-worth utilities for each individual (i^{th}) with the probabilities of an individual investor choosing an alternative investment estimated as a standard multinominal logit specification.[11] At the individual level, the probability (p_{ik}) of an individual investor (i^{th}) choosing the kth investment option in a particular choice task is estimated using the following real estate investment choice model:

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[9] Multinomial Logit (MNL) analysis, which examines the relative importance of attributes by considering the difference each attribute could make to the total utility of a real estate asset, is used in a preliminary analysis to check the robustness of the results and thus the appropriateness of proceeding with the HB analysis.

[10] The top level model, a multivariate logit model with random effects to allow parameters to vary across individuals, derives sample averages from 51 respondents, each performing 20 tasks. This prior and posterior information from the between and within group estimations informs the likelihood provided by the lower level model as specified in Equation 7. A total of 1020 observations were collected at each survey point enabling segmentation and analysis and, as recommended with relatively small samples design, efficiency tests were undertaken before and after the fieldwork to ensure the survey design was efficient.

[11] The standard MNL model is specified as $p_k = \frac{e^{(U_k)}}{e^{U_1}+e^{U_2}+e^{U_3}}$ where the probability of selecting a specific investment is proportional to the total utility for that concept (U_k), estimated by adding the utility associated with each attribute level, relative to the total utility for the three options available (Sawtooth Software, 2009b).

$$p_{ik} = \frac{e^{x'_{ik}\beta_i}}{\sum_{j=1}^{J} e^{x'_{ij}\beta_i}} \tag{7}$$

Here, β_i represents individual *i*th's part-worth utility for the attribute levels of the kth alternative and $x'_{ij}$is a vector of estimated values describing the jth alternative in that choice task, $e^{x'_{ik}\beta_i}$is the exponential of the alternative investment utility and $\sum_{j=1}^{J} e^{x'_{ij}\beta_i}$ represents the sum of the exponential part-worth utilities for all the investment options. The part-worth utility parameters for each individual, along with the model's mean of the distributions of worths and the matrix of the variances and covariances associated with that distribution, are estimated by a Monte Carlo Markov Chain procedure. This is a statistically robust iterative procedure that determines the parameters employed in each iteration from the previous iteration using a constant set of probabilistic transition rules and continues for a large number of iterations until convergence is achieved. The final individual partworth estimates are derived by averaging the several thousand iterations saved (Sawtooth Software, 2009a).

4.2 Findings

Tables 6 and 7 show the results of the CBC analysis, with investor preferences towards attributes (Table 6) and attribute levels (Table 7) segmented by property market outlook, in each of the two EPU contexts. The tables show the segmented average importance of attributes and average utilities for attribute levels to reveal any differences in investment behaviour in each period and, furthermore, for investors with contrasting expectations.

[Insert Table 6]

4.2.1 Tenant creditworthiness

The creditworthiness of the tenant is, as expected above, consistently seen as very important in the decision to invest, ranked at third and second place in the early low and later high periods of EPU, respectively (as seen in Table 6). At an aggregate level, this desire for income security, consistent regardless of fluctuating EPU, might begin to explain the lack of relationship between EPU and income return at the aggregate level. Segmenting the results, again there is a high ranking when EPU is high, regardless of market expectations; and also when EPU is low, although only when expectations are for a rising or stable market. Creditworthiness is seen as less important to those with expectations of a falling market (or those with uncertain expectations), with the rent review clause taking its place in the ranking. Here, protecting the income stream through frequent/upwards-only reviews is seen to become a priority, with tenant default less of a concern under low EPU.

The most preferred level of creditworthiness in 2016, as seen in Table 7, is most often minimum risk of tenant default; only when the expectation is of market stability are investors willing to take on slightly greater risk. In the earlier period there was more variation, with some investors selecting tenants with lower covenant strengths, either indicating low expectations of tenant default when uncertainty is low, or perhaps the greater acceptance of an opportunistic investment style prior to the financial crisis.

[Insert Table 7]

4.2.2 Leasing factors

At an aggregate level, all four attributes relating to leasing characteristics are in the bottom half of investor preferences, with the one exception where BREEAM is ranked as seventh most important attribute, in the first period. The consistently low level of importance awarded to the finer leasing details of an asset perhaps, in part, further explains the insignificant relationship between income return and EPU at the all property level. Despite the low level of importance overall, the finer details do reveal that risk mitigation is a core concern generally, and more so in response to greater uncertainty.

Regarding diversity within the income stream generated by a property (*single or multi-let*), the highest level of multi-tenancy available to respondents (more than 5 tenants) is preferred when EPU is low, regardless of expectations of market movements, and this holds when EPU is higher, for those with expectations of a rising or a stable market. The least preferred is 2-5 tenants for these investors, although these preferences swap place where expectations are for a falling market. Those with an uncertain outlook prefer a single-let property, presumably where the tenant is carefully selected with a high quality covenant as identified above. Similarly, the preferences for the *rent review clause* and *period to expiry/break* indicate the controlling, or mitigation of risk. Over the last few decades there have been shifts in the characteristics of the typical UK lease, with both review periods and lease length falling, with break clauses more common. These changes represent increased risk to the stability of the investment income stream, with the UK lease structure historically providing high levels of certainty (and protection) to the investor. The desire to mitigate these risks becomes increasingly evident as EPU rises, with a slight shift in preference away from a 2-3 yearly review pattern, towards a review clause where the rent is set annually, linked to an index or turnover. This will enable investors to capture, more quickly, any market rises in rents received, important in periods of uncertainty. The result is, however, with the exception of those with mixed expectations who, perhaps surprisingly, prefer traditional rent reviews that take place every 4 or more years with no upwards only clause. Concern over risk to the income stream through expiry/break appears consistent regardless of EPU, with the almost 100% unanimous preference, regardless of expectations of performance, for the longest period to expiry/break (over 10 years) and, similarly, almost all least prefer the shortest period to expiry/break (less than 5 years).

There are some exceptions, however, where some of the finer details are less clear. For example, whether the property is *single or multi-let* is less important to investors under higher EPU (ranked fifth most important attribute in 2007, but 8th in 2016). The only lack of consistency to this is that it is more important when EPU is higher for investors who are uncertain about market movements (where it is ranked 5th), which would be expected. The general fall in importance, however, is perhaps unexpected. Along with creditworthiness, the number of tenants and, therefore, diversification in cashflows comprising overall income, might be expected to be more important in times of uncertainty (notwithstanding management obligations).

The *user/assignment clause* is considered to be one of the least important factors in the decision to invest. In the earlier period of low EPU, there was unanimity that a standard clause is preferred, with a restrictive clause, which would restrict prospective tenant demand, least preferred. In the second period, of higher EPU, while those with expectations for a rising or falling market still prefer a standard user/assignment clause, those in a stable market prefer a relaxed or no user/assignment clause. The preference for a relaxed clause in a stable market might be an attempt, by some, to minimise any further restrictions on tenant base in a market where the future tenant demand is uncertain due to rising EPU. That said, the preference for a restrictive user clause by those with a mixed outlook suggests that some investors might prefer to keep tighter controls on the tenant mix, perhaps as a way to manage the uncertainty. It is clear that investor behaviour is complex and nuanced.[12]

4.2.3 Location

There was a 100% unanimous preference for the location attribute in 2007, both in terms of location being the most important factor to investors regardless of expectations of performance (Table 6), and also for that location to be a town or city centre prime pitch (Table 7). Although this holds for the aggregated sample in 2016, it does vary when the sample is segmented, with only those who expect the market to be stable or fall favouring it as the most important attribute; while it is seen as the second most important attribute for those who see the market rising and also those with mixed views about future market conditions. Despite this ranking in second place, the utility levels for location are greater than for any other attribute for those that ranked location as most preferred. Across all groups there is consistency in that in-town or city centre is the most preferred location and that the least preferred location at both survey points is one with no existing public transport, either in a suburban location if expectations are for a rising market, or in an out-of-town location where expectations are for a stable or falling market.

These consistent preferences for (a prime and central) location when selecting stock, arguably indicate a concern for minimising both risk and uncertainty in long-term investment returns, across all measures of return. Rising EPU only seems to strengthen this behaviour (evidenced by the higher average utility given to location for the sample as a whole), often termed a flight to safety or "institutional conservatism" by Keogh (1994; p. 67) in the real estate market, and found in the equities market by Ulrich (2012).

4.2.4 Building risk

One finding that stands out above all others is the preferences of investors towards properties with sustainability ratings, specifically the *BREEAM rating*. However, this is the one attribute where the context for the investment decision has changed fundamentally during the time between the two surveys. Sustainability has risen markedly in priority for all investors between the two survey periods; in the first survey it was in the bottom half of the preference rankings (7th out of the eight attributes) but is up to 3rd most preferred attribute in the later survey, overall. During this decade sustainability awareness and actions increased generally, with perhaps a shifting of investors' strategic objectives encouraged by the Energy Act 2011 and possibly even pre-emptive action arising from cautiousness stemming from the uncertainty surrounding future environmental policy and debates around tightening the EPC requirements.

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[12] The fund strategy was collected from respondents, but the results cannot be disaggregated further by this additional variable due to the resulting small sample sizes.

The rising importance of the sustainability rating in the acquisition decision indicates, it may be argued, a concern towards the "future-proofing" of investment performance. Control, or mitigation of future risk, is a key component of total returns and is especially important in times of uncertainty. Investment behaviour, such as seen here, will be one of the factors underpinning the significant relationship where changes in EPU are seen to Granger-Cause changes in transaction-transaction-linked capital change, not just in the all property aggregated analysis above, but also in office, industrial and retail sectors. Indeed, in both survey periods the results indicate that the BREEAM rating of a property becomes increasingly important as expectations of market performance move to that of a falling market. Furthermore, in the latter period, of higher EPU, the BREEAM rating is the most sought after attribute for investors with mixed, or unclear, expectations of market movement. This may be further explained through one possible consequence of rising EPU being indecisiveness, with Knightian Decision Theory implying that ambiguity might result in incomplete preferences, with indecisive individuals choosing the status quo (or future-proofing) option when there is no clear alternative option to this (Sautua, 2017).

In contrast to the marked rising importance placed on the BREEAM rating, the ranking for *economic and functional obsolescence* is generally high and consistent. It was consistently identified as the second most important attribute in the first survey period, across all groups of respondents regardless of market expectation, but preference given to this attribute varied when EPU was higher. Then, it was rated the most important variable in a rising, and second place in a stable, market. However, it falls to 4th most important attribute in a falling market (behind location, BREEAM rating and creditworthiness of the tenant) and even further in the priorities given by the investors who had mixed views of how the market would perform in the short run (behind additional attributes reflecting leasing factors). The fall in importance of economic and functional obsolescence as both EPU rises and market expectations worsen, may reflect an immediate short-term priority of seeking a secure income stream, with tenant and leasing attributes being increasingly important. It may also reflect, however, a rise in (some) investors moving towards investment strategies (such as core+ or value-added) that grant opportunities for higher returns by working assets more, particularly during falling markets. A consequence of this is that they place less importance on obsolescence at acquisition (INREV, 2016; 2017).

Notwithstanding this, the preferred level of specification and internal configuration is most often high specification and flexible internal configuration, with low spec/flexibility least preferred. Properties with the greatest flexibility should, *ceteris paribus*, attract the highest level of user demand over the longer term and, thus, provide attractive investment performance. Further, high spec premises should, it can be argued, be attractive to tenants with good covenant strength who are seeking long-term occupation, the holy grail of many (core) investment strategies. This further indicates ex-ante risk management strategies are a consideration in the decision-making process, with a degree of risk-taking an inherent element of non-core funds.

5.0 Discussion and Conclusions

This paper has sought to extend our knowledge and appreciation of the factors that underpin the performance of real estate, by examining whether, and how, the investment market and, further, investment decision-making, varies in times of different economic policy uncertainty. It is pioneering in that it is the first published study to explore the complex relationships between uncertainty, behaviour and pricing in the commercial property market. It does this using Crosby et al.'s (2016) pricing framework, specifically recognising the complexities of the real estate market, to guide the overall design and analytical approach. The paper is able to offer a new richness of analysis through its multi-stage and multi-level approach, reflecting both the macro and micro elements of the real estate risk premium.

Thus, exploring the macro element of the risk premium, like earlier studies into the effects of EPU in the stock and housing markets, this study finds evidence that inter-connections exist between policy uncertainty and performance of the real estate sector overall, before moving on to reveal more nuanced results for the individual office, industrial and retail sectors. This stage is, however, only half of the story regarding pricing and, thus, performance as, using the Crosby et al. model, this provides insights only into links between uncertainty and real estate at the level of the real estate market. It is argued that, to truly explore whether and how behaviour and pricing in the real estate market respond to changing EPU, there also needs to be recognition of the pricing of property-specific attributes, which form the second part of the model, and which, additionally, begin to explain the aggregated results.

In more detail, in the first stage, Granger-Causality tests were used to determine whether movement in investment returns is responsive to fluctuations in uncertainty, as measured by economic policy news, or if returns drive policy uncertainty. The results reveal that two-way Granger-Causality exists between aggregated all-property total returns and EPU; with mixed results for capital growth and income return performance measures. At the sectoral level, these results hold for the relationship between total returns and EPU in the office sector but variations in the results reflect the specifics of the investment and occupier markets across the main sectors. A result of note is that, for all three sectors, the results suggest that there is evidence that the market can affect government policy choices. In the retail and industrial markets this appears to come from the occupier sector, perhaps reflecting the greater visibility and, thus, possibly more newsworthy nature of these sub-markets, especially given the expansion of logistics within the industrial sector, linked to the retail sector. The direction of this relationship may be the subject of debate, however, and could usefully form the focus for further research. The links between EPU and capital returns are much stronger and bi-directional in the office sector, suggesting political uncertainty has a greater effect on property yields and that there is a risk premium associated with an uncertain political environment, supporting Brogaard and Detzel's (2015) finding that EPU levels have a greater effect on stock discount rates than net cash flows.

Following these first insights, a highly granular approach was used in the micro-level second stage of investigation. Here, exploring the pricing of stock-specific attributes within the study framework, individual purchase investment decisions were examined and the results explored not just with regard to uncertainty, but to see whether individual behaviours might begin to explain the findings of the first stage. This stage of the study unpicked and revealed investors' preferences under different EPU conditions, something that has never been done before. This was possible through a novel method of data collection and the development of an analytical approach to examine how shifting levels of EPU impact on investment purchase preferences and pricing behaviour.

A number of results seem to provide clear findings. At both the all-property level and the sectoral level, the results in the first stage revealed that movements in income return do not respond to changes in EPU, with the second stage revealing that the behaviour of investors shows concern for income security (through tenant creditworthiness) that is consistent regardless of levels of uncertainty. Furthermore, although concern for finer leasing details are comparatively low in investor preferences, again regardless of uncertainty, there is a high degree of consistency in risk mitigation in choices made. There are, as would be expected, some variations in preferences in different EPU regimes, such as when a more relaxed concern over tenant default in times of low EPU allows a switch in preference towards more frequent reviews if the market is expected to fall.

In contrast to income returns, the results showed a stronger relationship between EPU and total returns, especially in the all-property and office sector, and capital returns, again for the all-property and office sectors but also additionally revealed through the transaction-linked data, suggesting yields respond more to uncertainty. This is evident when investors are selecting stock for acquisition, with those variables that, arguably, indicate a concern for future-proofing. For example, the utility levels for location across the sample as a whole are higher when there is greater uncertainty and this is even more marked for the prime central location preferred. Enhanced concern for future-proofing is also seen in the far higher importance placed on the BREEAM rating of the asset in the second period, although it is not possible to distinguish whether raised uncertainty, or increased awareness generally, is the cause for this. While this increased awareness could have been driven by the increased importance given by many occupiers and investors to sustainability in their business operations, such significant structural changes are not replicated in the other risk components, between the two periods.

Under certainty, Jansen van Vuuren (2017) deduced that market agents would display “hyper-rationality”, resulting in homogenous investors with the same preferences that would not adapt their future behaviour in response to exogenous changes. However, if normal uncertainty exists then the imperfect knowledge and bounded rationality would give rise to heterogeneous investors with varying preferences. Yet, under abnormal uncertainty, irrationality kicks in and behavioural patterns become unclear. We see, perhaps, evidence of bounded rationality in some of our findings, where preferences vary across heterogeneous investors, as evidenced by different expectations of market direction and, underpinning this, the adoption of different investment strategies as would be expected with uncertainty. In addition, we see, perhaps, evidence of unclear behavioural patterns, associated with irrationality, through those fund managers that are least clear about the future and have purchasing preferences that stand out as being very different to other fund managers.

These findings have significant implications. From a policy perspective, the results indicate that high economic policy uncertainty can have significant, even destabilising, effects on the property market, as pricing responds. While much is still to be learnt about the role of government in property investment pricing, policy makers need to be aware that untimely policy changes or lack of clarity around future economic policy decisions can increase risk to investors, and that they need to consciously seek out remedies to reduce uncertainty on business and investment confidence and in the economy. Turning away from the measure of EPU used here, issues around confidence and uncertainty have increased significantly in recent years with the now immediate and rapid debate and challenges to accountability that take place within social media.

Finally, the study has confirmed that EPU is an investment risk factor and, furthermore, that it is reflected in (some) pricing behaviour. Rational investors, wanting to reduce the vulnerability of their holdings to EPU, will want to weight portfolios in favour of less EPU-sensitive assets when uncertainty is expected to rise. The findings in this study indicate that the leisure and hotel sectors offer such opportunities, with returns not linked to EPU. These are growth sectors and long-term consistency in this finding is not certain. Future research into property pricing, such as an extension to the Crosby et al pricing framework, should explicitly allow for EPU. Conversely, and importantly, there are findings that reveal that EPU responds to the property market, confirming the importance of the sector to economic stability. Linked to this, and not just regarding domestic investment, policy-makers should note the evidence of the complex bi-directional relationship between uncertainty and market performance. This provides evidence supporting Brogaard and Detzel's (2015) discussion on how heightened uncertainty around a country's future institutional framework can impact on investment decisions, which may, as noted by Lieser and Groh (2014) deter inward foreign investment flows.

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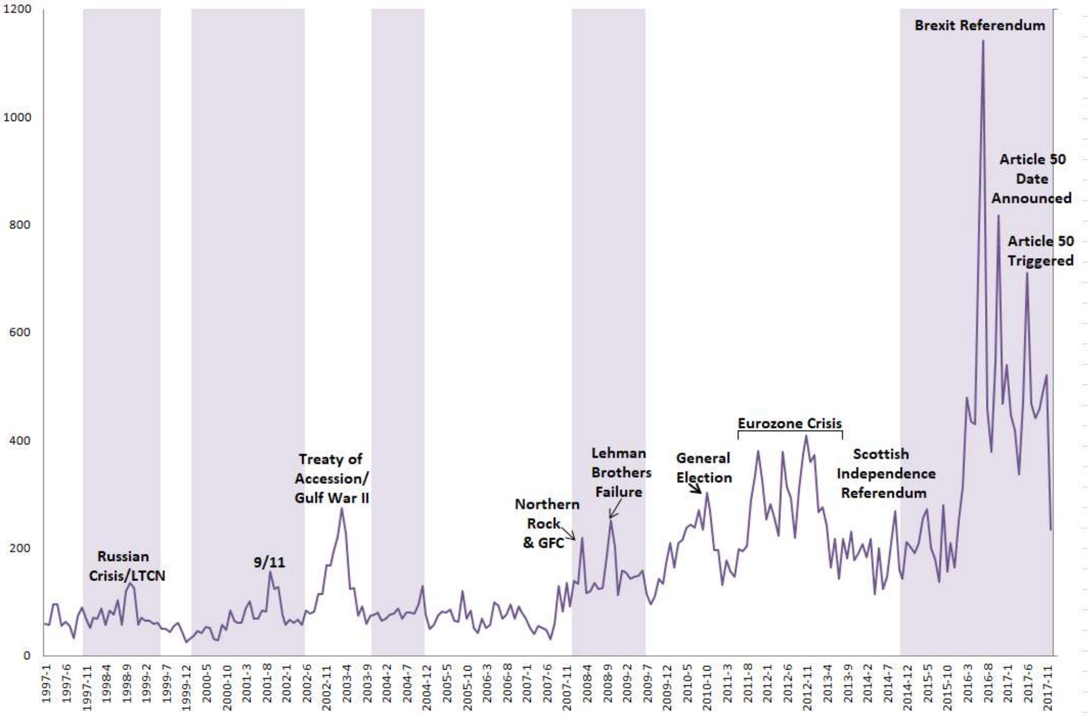
Figure 1: EPU Index in the United Kingdom



Source: adapted from Baker et al (2016); Baker, Bloom and Davis at www.PolicyUncertainty.com; and OEDC (2018).

Table 1: Augmented Dickey-Fuller Test Statistics, January 1997 to December 2017 Data

	TAR-TAR Desmoothed Real Data					
	ADF Test Levels		**Lag Length**	**ADF Test Differenced**		**Lag Length**
	Real Total Return					
All Property (RP_{REM})	0.994		2	-14.109	*	1
Sector (RP_{sct}): Office	0.960		1	-18.314	*	0
Industrial	-0.775		3	-6.537	*	2
Retail	-1.204		0	-15.524	*	0
Other	0.635		2	-6.584	*	1
Hotel$^{\#}$	1.678		1	-12.429	*	0
Leisure$^{\#\#}$	-0.684		3	-6.911	*	2
	Real Capital Growth					
All Property (RP_{REM})	-1.331		2	-14.476	*	1
Sector (RP_{sct}): Office	-0.876		0	-17.934	*	0
Industrial	-1.534		3	-6.790	*	2
Retail	-1.819		0	-16.315	*	0
Other	-1.336		0	-10.044	*	0
Hotel$^{\#}$	-1.120		0	-14.058	*	0
Leisure$^{\#\#}$	-1.098		4	-6.341	*	3
	Real Income Return					
All Property (RP_{REM})	-0.166		3	-5.689	*	2
Sector (RP_{sct}): Office	-0.857		0	-7.088	*	2
Industrial	-0.374		0	-16.002	*	0
Retail	-1.054		0	-2.197		11
Other	-0.377		0	-17.728	*	0
Hotel$^{\#}$	-1.026		12	-1.779		11
Leisure$^{\#\#}$	-4.256	*	14	-8.499	*	10

$^{\#}$ August 2000 to December 2017; $^{\#\#}$ November 1998 to December 2017.

* rejects null hypothesis that the time series contains unit root at 1% significance level; ** rejects the null hypothesis at 5% significance level; *** rejects the null hypothesis at 10% significance level.

Table 2: Unrestricted Bi-variate VAR Granger Causality Tests, January 1997 to December 2017 TAR-TAR Data[13]

Sector	Chi-sq	df			Chi-sq	df	
All Property				**Other Property**			
EPU does not Granger-Cause Real Total Return	37.878	11	*	EPU does not Granger-Cause Real Total Return	3.093	5	
Real Total Return does not Granger-Cause EPU	38.447	11	*	Real Total Return does not Granger-Cause EPU	16.249	5	*
EPU does not Granger-Cause Real Capital Growth	19.668	10	**	EPU does not Granger-Cause Real Capital Growth	1.458	5	
Real Capital Growth does not Granger-Cause EPU	24.085	10	*	Real Capital Growth does not Granger-Cause EPU	5.394	5	
EPU does not Granger-Cause Real Income Return	3.663	4		EPU does not Granger-Cause Real Income Return	11.380	12	
Real Income Return does not Granger-Cause EPU	2.487	4		Real Income Return does not Granger-Cause EPU	26.184	12	**
Office Property				**Hotel Property**[#]			
EPU does not Granger-Cause Real Total Return	49.917	12	*	EPU does not Granger-Cause Real Total Return	0.997	5	
Real Total Return does not Granger-Cause EPU	52.335	12	*	Real Total Return does not Granger-Cause EPU	11.124	5	**
EPU does not Granger-Cause Real Capital Growth	31.610	11	*	EPU does not Granger-Cause Real Capital Growth	0.206	3	
Real Capital Growth does not Granger-Cause EPU	30.219	11	*	Real Capital Growth does not Granger-Cause EPU	0.757	3	
EPU does not Granger-Cause Real Income Return	1.530	3		EPU does not Granger-Cause Real Income Return	6.018	12	
Real Income Return does not Granger-Cause EPU	5.116	3		Real Income Return does not Granger-Cause EPU	19.022	12	***
Industrial Property				**Leisure**[##]			
EPU does not Granger-Cause Real Total Return	6.528	5		EPU does not Granger-Cause Real Total Return	3.387	4	
Real Total Return does not Granger-Cause EPU	16.021	5	*	Real Total Return does not Granger-Cause EPU	9.421	4	**
EPU does not Granger-Cause Real Capital Growth	3.177	4		EPU does not Granger-Cause Real Capital Growth	0.735	4	
Real Capital Growth does not Granger-Cause EPU	4.080	4		Real Capital Growth does not Granger-Cause EPU	0.703	4	
EPU does not Granger-Cause Real Income Return	10.702	12		EPU does not Granger-Cause Real Income Return	1.231	3	
Real Income Return does not Granger-Cause EPU	12.072	12		Real Income Return does not Granger-Cause EPU	2.412	3	
Retail Property				# - August 2000 to December 2017; ## - November 1998 to December 2017. * rejects null hypothesis that the time series contains unit root at 1% significance level. ** rejects the null hypothesis at 5% significance level. *** rejects the null hypothesis at 10% significance level. + retail income returns data second differenced.			
EPU does not Granger-Cause Real Total Return	8.785	9					
Real Total Return does not Granger-Cause EPU	16.018	9	***				
EPU does not Granger-Cause Real Capital Growth	3.924	6					
Real Capital Growth does not Granger-Cause EPU	5.085	6					
EPU does not Granger-Cause Real Income Return[+]	8.799	12					
Real Income Return does not Granger-Cause EPU[+]	24.794	12	**				

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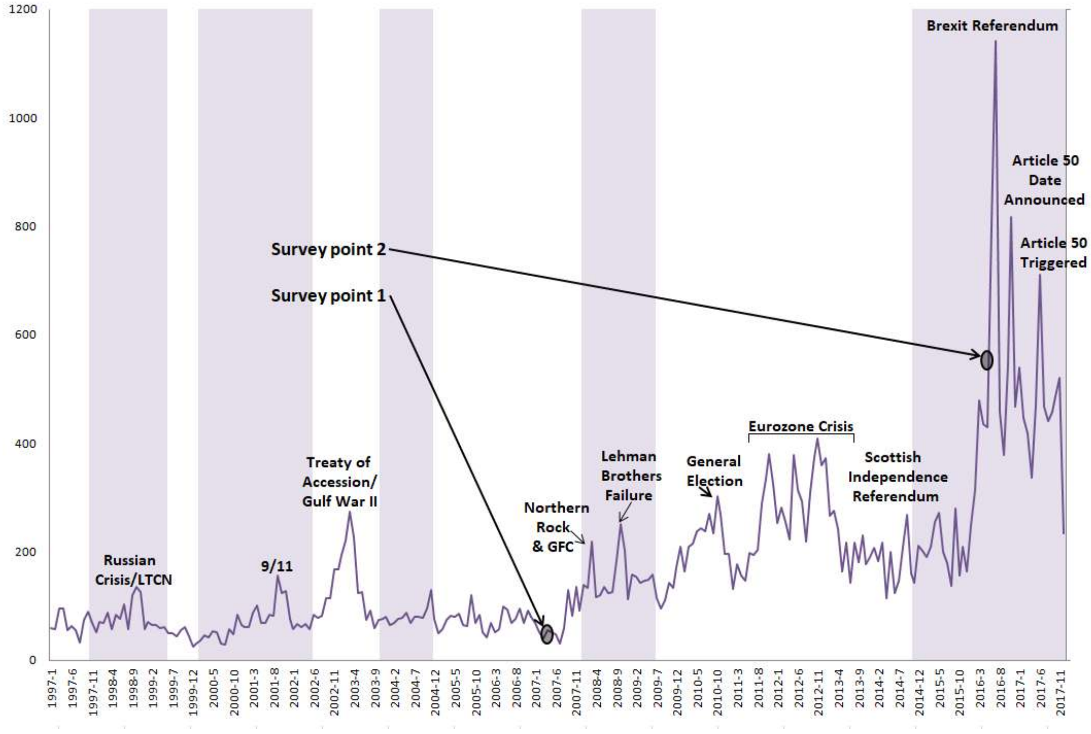
[13] The results in the table were generated using Equations 5 and 6 and fully align with those generated by testing the initial version of the model represented by Equations 3 and 4. The market rental growth index was also tested but found to generate no significant Granger Causality results.

Figure 2: Survey points



Source: adapted from Baker et al (2016); Baker, Bloom and Davis at www.PolicyUncertainty.com; and OEDC (2018).

Table 3: Attributes and levels specified in the two surveys

RP_{STK} component (Equation 2)	**Attributes**	**Levels specified in 2007 study**	**Levels specified in 2016 study**
RP_{ten} (tenant risk)	Creditworthiness	1) D&B 5AA rating 2) D&B 3AA or 4AA rating 3) D&B 1AA or 2AA rating 4) D&B AA or BB or CC rating 5) D&B DD or lower rating	*1) Minimum risk of tenant default* *2) Lower than average risk of tenant default* *3) Higher than average risk of tenant default* *4) High risk of tenant default*
RP_{lse} (leasing risk factors)	Single or multi-let	1) Single let property 2) 2-5 tenants 3) More than 5 tenants	1) Single let property 2) 2-5 tenants 3) More than 5 tenants
	Rent review clause	1) Rent set annually, linked to index or turnover 2) Rent review every 2 to 3 years, upwards only clause 3) Rent review every 4 or more years, upwards only clause 4) Rent review every 2 to 3 years, no upwards only clause 5) Rent review every 4 or more years, no upwards only clause	1) Rent set annually, linked to index or turnover 2) Rent review every 2 to 3 years, upwards only clause 3) Rent review every 4 or more years, upwards only clause 4) Rent review every 2 to 3 years, no upwards only clause 5) Rent review every 4 or more years, no upwards only clause
	Period to expiry/ break	1) Less than 5 years 2) 5-10 years 3) Over 10 years	1) Less than 5 years 2) 5-10 years 3) Over 10 years
	User/ Assignment clause	1) Restrictive user/assignment clause 2) Standard user/assignment clause 3) Relaxed or no user/assignment clause	1) Restrictive user/assignment clause 2) Standard user/assignment clause 3) Relaxed or no user/assignment clause
RP_{locs} (stock location risk)	Location	1) In town or city centre 2) Suburban, close to existing public transportation 3) Suburban, no existing public transportation 4) Out of the town/city, close to existing public transportation 5) Out of the town/city, no existing public transportation	*1) Town or city centre, prime pitch* *2) Town or city centre, secondary pitch* 3) Suburban location, close to existing public transportation 4) Suburban location, no existing public transportation 5) Out of the town/city, close to existing public transportation 6) Out of the town/city, no existing public transportation
RP_{bld} (building risk)	BREEAM rating	1) Pass 2) Good 3) Very good 4) Excellent 5) Not known	1) Pass 2) Good 3) Very good 4) Excellent *5) Outstanding* 6) Not known
	Economic and functional obsolescence	1) High spec and flexible internal configuration 2) Average spec and internal configuration 3) Low spec and inflexible internal configuration	1) High spec and flexible internal configuration 2) Average spec and internal configuration 3) Low spec and inflexible internal configuration

Table 4 Characteristics of respondents and comparison with composition of total sample

	2007 Respondents		**2016 Respondents**		
	No.	**%**	**No.**	**%**	**(Total Sample %)**
Gender					
Male	46	90.2	45	88.2	(87.5)
Female	5	9.8	6	11.8	(12.5)
Current position					
Acquisition analyst/surveyor	5	9.8	1	2.0	(1.2)
Asset manager	1	2.0	1	2.0	(1.8)
Fund/portfolio manager	15	29.4	31	60.8	(57.1)
Director/head of property/investment	26	51.0	15	29.4	(37.2)
Chief executive	2	3.9	1	2.0	(1.8)
Other	2	3.9	2	3.9	(0.9)
Experience in current role					
0 to 5 years	11	21.6	19	37.3	N/A
6 to 10 years	9	17.6	19	37.3	N/A
> 10 years	31	60.8	13	25.5	N/A
Total	**51**	100.0	**51**	100.0	

Table 5: Categorisation of respondents' expectation about property market conditions

Survey respondents' stated expectations over the coming year				Respondent numbers in each category	
Property rents	**Property yields**	**Interpretation**	**Categorisation**	**2007**	**2016**
rising	falling	Yields indicating positive investor expectations, accompanied with stable or rising rental growth	**Rising market**	25	8
stable	falling				
stable	stable	Yields indicating expectations of stabilisation	**Stable market**	18	24
slowing/falling	stable				
rising	stable				
slowing/falling	rising	Yields indicating negative investor expectations, accompanied with stable or falling rental growth	**Falling market**	5	10
stable	rising				
falling	falling	Yields and rental growth moving in contrary to market norms	**Uncertain market**	3	9
			Total	51	51

Table 6: Attribute Importance, Segmented by Property Market Outlook, HB Estimation

	2007					2016				
	Aggregate Total	**Rising**	**Stable**	**Falling**	**Uncertain**	**Aggregate Total**	**Rising**	**Stable**	**Falling**	**Uncertain**
Total	51	25	18	5	3	51	8	24	10	9
Creditworthiness of the tenant	12.563	12.910	14.430	8.720	*4.850*	18.352	16.518	13.712	12.956	16.890
Single or multi-let	11.336	13.250	9.410	9.980	9.220	*5.570*	*5.730*	*5.296*	7.456	6.482
Rent review clause	12.094	11.230	12.280	13.490	15.850	8.857	6.849	10.244	12.679	9.563
Period to expiry/break	8.473	9.170	8.470	*4.850*	8.720	9.132	7.408	7.639	9.400	4.271
User/assignment clause	*7.924*	*7.180*	8.660	8.940	7.980	5.875	7.334	5.956	*6.408*	*3.214*
Location	**22.211**	**20.580**	**22.600**	**27.240**	**25.130**	**26.115**	19.109	**28.853**	**22.423**	25.474
BREEAM rating	8.309	8.090	*7.920*	10.390	8.950	13.182	15.616	13.557	15.724	**28.982**
Economic and functional obsolescence	17.090	17.590	16.210	16.400	19.300	12.917	**21.437**	14.742	12.954	5.125

Note: Highest average utilities (part-worths) are depicted in **bold** and lowest in *italics*, for ease of analysis.

Table 7: Attribute Levels, Segmented by Property Market Outlook, HB Estimation

	2007					2016				
	Aggregate Total	**Rising**	**Stable**	**Falling**	**Uncertain**	**Aggregate Total**	**Rising**	**Stable**	**Falling**	**Uncertain**
Total Respondents	51	25	18	5	3	51	8	24	10	9
D&B 5AA rating for tenant(s) (Minimum risk of tenant default)	**31.610**	**31.050**	**40.820**	13.380	**11.370**	**57.228**	**66.173**	28.847	**36.754**	**56.315**
D&B 3AA or 4AA rating for tenant(s) (Lower than average risk)	7.203	12.050	9.010	-6.040	*-21.940*	37.612	42.972	**42.258**	26.701	14.543
D&B 1AA or 2AA rating for tenant(s) (Higher than average risk)	9.169	7.610	10.310	9.560	14.670	-24.083	*-58.336*	-26.898	-26.141	7.886
D&B AA or BB or CC rating for tenant(s) (High risk of default)	-1.776	-1.950	-7.130	**15.000**	3.820	*-70.757*	-50.809	*-44.206*	*-37.315*	*-78.744*
D&B DD or lower rating for tenant(s)	*-46.207*	*-48.770*	*-53.000*	*-31.900*	-7.920					
Single let property	*-44.551*	*-51.890*	*-35.750*	*-39.830*	*-44.020*	2.261	-3.477	2.153	-4.079	**14.314**
2 to 5 tenants	13.857	14.710	13.650	9.720	14.840	*-4.646*	*-16.633*	*-4.810*	**20.259**	-5.401
More than 5 tenants	**30.694**	**37.180**	**22.100**	**30.100**	**29.180**	**2.386**	**20.110**	**2.657**	*-16.180*	*-8.913*
Rent set annually, linked to index or turnover	5.995	1.250	5.520	**41.270**	-10.390	**13.939**	**22.947**	1.467	**36.253**	*-36.503*
Rent review every 2 to 3 years, upwards only clause	**31.226**	**29.500**	**30.530**	29.670	**52.340**	-1.180	-10.610	**28.814**	*-45.510*	-4.489
Rent review every 4 or more years, upwards only clause	20.225	19.150	24.820	8.750	20.730	-2.764	*-16.103*	9.227	-4.626	-3.248
Rent review every 2 to 3 years, no upwards only clause	*-30.386*	*-27.510*	*-33.320*	-31.340	*-35.120*	2.993	-8.782	-17.140	23.810	17.380
Rent review every 4 or more years, no upwards only clause	-27.060	-22.390	-27.550	*-48.350*	-27.570	*-12.988*	12.546	*-22.368*	-9.927	**26.860**
Less than 5 years to expiry/break	*-23.464*	*-26.070*	*-28.620*	*-17.190*	**18.680**	*-24.297*	*-26.992*	*-22.477*	-6.184	*-1.867*
5 to 10 years to expiry/break	0.747	-0.860	2.160	2.310	3.090	0.013	-0.850	-2.382	*-14.373*	0.229
Over 10 years to expiry/break	**22.717**	**26.930**	**26.460**	**14.880**	*-21.770*	**24.284**	**27.842**	**24.859**	**20.557**	**1.638**
Restrictive user/assignment clause	*-25.488*	*-23.610*	*-30.710*	*-23.300*	*-13.470*	*-5.669*	*-33.744*	*-7.557*	4.427	**3.553**
Standard user/assignment clause	**18.671**	**12.330**	**22.890**	**33.240**	**21.980**	**6.014**	**17.947**	-4.197	**15.030**	*-3.264*
Relaxed or no user/assignment clause	6.817	11.280	7.830	-9.930	-8.510	-0.345	15.797	**11.754**	*-19.458*	-0.288
In town or city centre (prime pitch)	**80.822**	**77.470**	**77.750**	**107.580**	**82.580**	**116.477**	**63.398**	**125.683**	**104.919**	**99.164**
In town or city centre (secondary pitch)						-18.006	-23.649	11.738	-18.205	-9.403
Suburban, close to existing public transportation	28.924	25.050	30.780	28.610	50.610	45.733	50.409	23.169	51.604	73.629
Suburban, no existing public transportation	-63.649	*-64.170*	-51.580	*-109.950*	-54.510	*-77.373*	*-80.482*	-76.888	-40.815	*-104.537*
Out of the town/city, close to existing public transportation	27.557	22.490	29.000	42.150	36.820	-2.965	48.061	-1.872	-32.097	-6.738
Out of the town/city, no existing public transportation	*-73.654*	-60.830	*-85.950*	-68.390	*-115.510*	-63.866	-57.737	*-81.829*	*-65.406*	-52.115
BREEAM pass rating	-4.298	-2.560	-10.480	12.280	-9.310	*-47.168*	20.380	*-46.573*	*-54.921*	-5.934
BREEAM good rating	*-10.950*	*-12.360*	*-13.070*	-0.960	-3.150	8.529	9.073	1.031	**36.739**	19.556
BREEAM very good rating	**20.525**	**22.620**	**13.680**	**30.950**	**26.730**	21.980	**35.906**	29.062	14.598	30.736
BREEAM excellent rating	-7.299	-4.350	-0.070	*-42.120*	*-17.230*	27.216	8.024	0.550	17.208	**83.441**
BREEAM rating: Outstanding						**31.216**	-0.438	**35.423**	18.026	20.460
BREEAM rating not known	2.022	-3.350	9.930	-0.150	2.970	-41.773	*-72.945*	-19.493	-31.650	*-148.261*
High specification and flexible internal configuration	**61.817**	**63.760**	**56.710**	**64.860**	**71.160**	**41.139**	**52.634**	**58.934**	**35.669**	0.483
Average specification and internal configuration	8.237	12.700	3.270	1.470	12.120	12.474	52.347	-2.376	9.821	**3.503**
Low specification and inflexible internal configuration	*-70.054*	*-76.460*	*-59.980*	*-66.320*	*-83.280*	*-53.612*	*-104.981*	*-56.558*	*-45.490*	*-3.986*
None	44.424	33.450	70.930	3.740	44.590	147.774	157.836	116.044	104.411	162.305

Note: Highest average utilities (part-worths) are depicted in **bold** and lowest in *italics*, for ease of analysis.

APPENDIX

Table 1A: Augmented Dickey-Fuller Test Statistics, January 1997 to December 2017, Raw Data

	Raw Real Data				
	ADF Test Levels	Lag Length	ADF Test Differenced		Lag Length
EPU	-2.156	4	-9.343	*	3
Real Total Return					
All Property (RP_{REM})	-1.140	2	-4.128	*	1
Sector (RP_{sct}): Office	-0.699	1	-5.436	*	0
Industrial	0.434	2	-2.647	***	1
Retail	-1.886	2	-4.077	*	1
Other	0.631	2	-6.562	*	1
Hotel[#]	1.358	1	-9.485	*	0
Leisure[##]	-0.212	2	-4.392	*	1
Real Capital Growth					
All Property (RP_{REM})	-1.395	1	-4.857	*	0
Sector (RP_{sct}): Office	-1.597	1	-5.162	*	0
Industrial	-1.717	13	-3.070	**	12
Retail	-2.362	7	-4.816	*	0
Other	-1.329	1	-10.154	*	1
Hotel[#]	-1.130	1	-10.991	*	0
Leisure[##]	-1.453	2	-5.122	*	1
Real Income Return					
All Property (RP_{REM})	-0.285	13	-2.752	***	12
Sector (RP_{sct}): Office	-1.231	13	-2.639	***	12
Industrial	-0.216	13	-2.462		12
Retail	0.347	13	-2.697	***	12
Other	0.110	13	-2.971	**	12
Hotel[#]	-2.515	13	-2.368		12
Leisure[##]	0.750	13	-2.438		12

[#] August 2000 to December 2017; [##] November 1998 to December 2017.

* rejects null hypothesis that the time series contains unit root at 1% significance level; ** rejects the null hypothesis at 5% significance level.

Table A2: Unrestricted Bi-variate VAR Granger Causality Tests, January 1997 to December 2017, Raw Data

Sector	Chi-sq	df		Sector	Chi-sq	df	
All Property	**RAW DATA**			**Other Property**	**RAW DATA**		
EPU does not Granger-Cause Real Total Return	28.807	12	*	EPU does not Granger-Cause Real Total Return	3.164	5	
Real Total Return does not Granger-Cause EPU	36.542	12	*	Real Total Return does not Granger-Cause EPU	16.440	5	*
EPU does not Granger-Cause Real Capital Growth	18.932	11	***	EPU does not Granger-Cause Real Capital Growth	1.302	5	
Real Capital Growth does not Granger-Cause EPU	14.314	11		Real Capital Growth does not Granger-Cause EPU	5.598	5	
EPU does not Granger-Cause Real Income Return	7.791	12		EPU does not Granger-Cause Real Income Return	7.816	12	
Real Income Return does not Granger-Cause EPU	24.547	12	*	Real Income Return does not Granger-Cause EPU	24.498	12	**
Office Property				**Hotel Property[#]**			
EPU does not Granger-Cause Real Total Return	30.475	12	*	EPU does not Granger-Cause Real Total Return	1.436	5	
Real Total Return does not Granger-Cause EPU	39.751	12	*	Real Total Return does not Granger-Cause EPU	14.356	5	**
EPU does not Granger-Cause Real Capital Growth	15.929	7	**	EPU does not Granger-Cause Real Capital Growth	0.915	5	
Real Capital Growth does not Granger-Cause EPU	7.444	7		Real Capital Growth does not Granger-Cause EPU	4.784	5	
EPU does not Granger-Cause Real Income Return	7.827	12		EPU does not Granger-Cause Real Income Return	7.223	12	
Real Income Return does not Granger-Cause EPU	23.615	12	**	Real Income Return does not Granger-Cause EPU	20.651	12	***
Industrial Property				**Leisure[##]**			
EPU does not Granger-Cause Real Total Return	35.944	12	*	EPU does not Granger-Cause Real Total Return	8.698	5	
Real Total Return does not Granger-Cause EPU	37.407	12	*	Real Total Return does not Granger-Cause EPU	13.173	5	**
EPU does not Granger-Cause Real Capital Growth	14.737	9		EPU does not Granger-Cause Real Capital Growth	2.889	3	
Real Capital Growth does not Granger-Cause EPU	11.660	9		Real Capital Growth does not Granger-Cause EPU	1.990	3	
EPU does not Granger-Cause Real Income Return	8.192	12		EPU does not Granger-Cause Real Income Return	7.239	12	
Real Income Return does not Granger-Cause EPU	26.233	12	**	Real Income Return does not Granger-Cause EPU	22.798	12	**
Retail Property							
EPU does not Granger-Cause Real Total Return	25.678	11	*				
Real Total Return does not Granger-Cause EPU	22.446	11	**				
EPU does not Granger-Cause Real Capital Growth	14.975	11					
Real Capital Growth does not Granger-Cause EPU	11.084	11					
EPU does not Granger-Cause Real Income Return	7.674	12					
Real Income Return does not Granger-Cause EPU	24.589	12	**				

# - August 2000 to December 2017; ## - November 1998 to December 2017.

* rejects null hypothesis that the time series contains unit root at 1% significance level.

** rejects the null hypothesis at 5% significance level.

*** rejects the null hypothesis at 10% significance level.

Table A3: Transaction-Linked Index, 1999Q1 to 2017Q4 Data

Table A3.a: Augmented Dickey-Fuller Test Statistics

	ADF Test Statistic Levels	Lag Length	ADF Test Statistic Differenced		Lag Length
EPU	-1.450	0	-7.224	*	0
All Property (RP_{REM})	-1.567	1	-6.245	*	0
Sector (RP_{sct}): Office	-1.379	0	-7.267	*	0
Industrial	-1.181	0	-7.687	*	0
Retail	-1.469	1	-6.443	*	0

Table A3.b: Unrestricted Bi-Variate VAR Granger Causality Tests

	Chi-sq	df	
All Property			
EPU does not Granger-Cause Real TLI Capital Growth	8.359	1	*
Real TLI Capital Growth does not Granger-Cause EPU	2.208	1	
Office Property			
EPU does not Granger-Cause Real TLI Capital Growth	7.056	1	*
Real TLI Capital Growth does not Granger-Cause EPU	1.999	1	
Industrial Property			
EPU does not Granger-Cause Real TLI Capital Growth	12.870	3	*
Real TLI Capital Growth does not Granger-Cause EPU	1.549	3	
Retail Property			
EPU does not Granger-Cause Real TLI Capital Growth	14.634	3	*
Real TLI Capital Growth does not Granger-Cause EPU	2.273	3	