Modelling Credit Spreads on Commercial Mortgage Loans

1. Introduction

This analysis provides an insight into the determinants of commercial real estate loan pricing between different lender groups in the UK real estate finance market. The examination of the factors underpinning real estate loan pricing is key to understanding trends in lending standards and financial risks emanating from credit-fuelled real estate booms. Such risks have long been recognised and provide the motivation for this paper. Collyns and Senhadji (2002) point out that increases in the price of real estate may lead to a rise in lending to real estate, recognised as credit expansion, with a downward revision of the perceived risk of real estate lending. Davis and Zhu (2004) and Hott (2009) find strong linkages between credit and commercial property cycles and provide evidence of rising property prices causing credit expansions. Concerns about real estate booms leading to financial crises (see Lang et al., 2020; Shim, 2019; Jordà et al., 2015) prompt the question of whether loan pricing amongst different real estate lenders adequately reflects risk factors.

In the case of European real estate lending, since the global financial crisis (GFC) in 2008/09, regulators have demanded that banks apply tighter lending standards at periods of real estate booms . It is reasonable to argue that real estate loan pricing did not adequately reflect loan risk prior to 2008, which was ultimately reflected in the low pricing of subprime real estate loans. Dingell (2002) raises questions about the pricing of loans and specifically the lending risk premium, claiming that commercial banks may be supporting their fees by underpricing credit facilities as a loss leader to their clients. Multiple changes in banking regulation since 2008/09 have ensured that lending to real estate as an asset class has become more expensive for lenders in terms of risk pricing, which has led to higher loan pricing for borrowers. Recently some papers have addressed the issue of the impact of Basel regulation on loan

pricing. Most have focused on calibrated models and estimates of the likely costs of increased capital requirements vary widely, often reflecting different assumptions about this Modigliani-Miller offset (see Dagher et al. (2016) for a review). David Glancy et al. (2018) used US loan-level data from U.S. bank stress tests to identify how loan rates respond to a 50% increase in capital requirements for a subcategory of commercial real estate (CRE) loans. They estimate that for Commercial CRE Developments loan rates increase by 35 basis points, indicating that a one percentage point increase in required capital raises loan rates by about 8.8 basis points. Also, Benetton et al. (2017) find that higher risk weights resulted in significantly higher mortgage rates in the United Kingdom.

The present paper explores the impact of loan pricing differences from a different angle than Benetton and Glancy by identifying different lender groups active in the UK market and combining the regulatory pricing impact with further loan characteristics documented in previous US literature (eg Titman et al (2005)).

The key question this paper investigates is: which factors are responsible for the variation of spreads in commercial property loans? The research takes into account two different periods prior to the GFC and after, to address the impact of regulatory changes. The implementation of Basel III started from 1 January, 2013, with the preparation and transitioning period for the first adoption of new minimum common equity ratio and minimum tier-1 capital ratio levels. The changes in the definition of capital significantly changed the calculation of risk-weighted assets (RWA) and, hence, the capital costs for securitisation, trading book and counterparty credit exposures. Real estate exposures were included in the calculation requirements for RWA of alternative assets. Therefore, the paper examines whether these regulatory changes had an impact on the relative importance of factors affecting margins and pricing of commercial loans.

The present study attempts to offer some new insight into the pricing of commercial mortgage loans not designated for securitisation. Our research uses the credit spread between the loan margin and the risk-free rate (or the reference rate) to indicate the loan pricing differential across different lenders and through time and the paper specifically addresses the issue of heterogeneity of real estate loans and lenders in the United Kingdom to explain differences in credit spreads and loan pricing. This heterogeneity is captured by relating loan margins to loan characteristics, lender type, and property sector/asset.

At the outset, we should note that the database in this study utilises loans held on the balance sheets of different lenders; it does not include credit lines or loans bundled into securitised vehicles.

The empirical examination takes the form of a cross-sectional time-series study of the determinants of commercial mortgage loan margins. We examine the time-series variation in spreads by looking at two different periods prior to the GFC (2004 – 2011) and post GFC (2012 – 2018). The cut-off of the two periods is determined by several factors. Although the GFC started in 2008, many banks were closed for new financing in 2009/2010 and the majority of lending activity was related to the restructuring of old loans, which were not necessarily priced to market. Many loan portfolios were sold at a discount to new lenders while old ones closed down. In addition, key regulatory changes took effect from December 2012 onwards, while the period 2009 – 2011 was a transitioning period. The capital requirements directive CRD was adjusted during 2009 – 2012 through the implementation of CRD I, II, III, and IV. The UK also started the largest quantitative easing programmes (QE1 & QE2) during 2009 – 2012.

When examining commercial mortgages, pricing information is difficult to find in private debt markets. Our dataset contains empirically collected data during 2004 – 2018 from

lending organisations actively lending in the UK during this period. The data are compiled via a survey collecting aggregated loan portfolio data by property sector along with the lending criteria from lending organisations. Organisations, as part of the survey, provide the best loan pricing offers at different LTV levels for standard property types for a newly originated loan (see Appendix A).

Findings confirm that the key differences in loan pricing are based on regulatory differences amongst lenders in the UK market. One key lending measure that has been subject to regulation is the loan-to-value ratio (LTV). This can be seen in the increase in its relative effect on loan spreads post GFC. In addition to LTV, the empirical findings underline the significant role of the type of asset on loan spreads. The premium charged by UK mortgage banks and regional banks has risen post GFC unlike German banks where it has decreased. Further, the results establish regional differences in loan pricing in line with US findings. The effect both of prime and secondary assets on loan spreads has risen post GFC, but significantly more for secondary assets. Estimated premia post GFC are up in the range of twenty to sixty bps.

The remainder of the article is organised in six sections. Section two reviews studies from a rather limited literature on the subject. Section three outlines the methodology and section four discusses the variables we employ to explain spreads and data measurement. In section five the results of the panel analysis are presented and discussed, while section six contains the key implications of the study.

2. Related studies

The literature on European loan pricing for real estate lending is scarce, despite the size and importance of the direct debt quadrant in real estate investment. There are broadly two

different areas of literature relevant to the current paper. One area focuses on the link between mortgage pricing, default and mortgage characteristics. The other area is newly emerging analysing the impact of Basel Capital Requirements regulation and the bearing within the banking sector on loan pricing.

Many studies dated before the GFC 2008/09 are focused on the US mortgage and CMBS market. Titman and Torous (1989) show that mortgage characteristics, such as the LTV (loan to value) ratio, the mortgage amortisation rate and mortgage maturity are important determinants of mortgage risk. Their results indicate that an important determinant of the LTV ratio and the amortisation rate is the NOI (net operating income) to asset value ratio. They denote that properties with higher NOI to asset value ratios have mortgages with higher LTV ratios and higher amortisation rates.

Titman et al. (2005) examine the impact of underwriting metrics on loan pricing such as loan-to-value ratios (LTV) and interest coverage ratio (ICR) for the US market. In particular, these two metrics have been used widely throughout the US as well as European markets. The authors find that loan margins increase following periods when real estate markets perform poorly. In such periods, lenders are also financially weaker or deleverage. This can clearly be seen in the widening of credit spreads in 2008/2009. As most commercial mortgages involve large balloon payments at the end of their terms, Nichols and Cunningham (2008) indicate that sudden declines in the value of commercial property may significantly increase loan default risk, hence the widening of loan spreads. Both above studies highlight the importance of the phase of the real estate cycle – and imply the importance of the economic cycle – in the determination of loan margins and pricing.

Titman et al.'s (2005) empirical investigation indicates that mortgages on riskier property types tend to exhibit higher spreads. More importantly, these authors investigate the

endogeneity of the mortgage contract and examine the choices of individual originators or lenders' business models. They find that different originators have different risk preferences; some originators attract riskier clienteles, engaging mortgages with higher LTV ratios as well as mortgages on properties that are riskier. This is also an important observation for the UK market.

Different property types carry different degrees of risk that should impact on loan pricing. According to Titman and Torous (1998), properties like hotels, which are likely to be both riskier and have the greatest investment flexibility, have significantly higher loan spreads than warehouses and multifamily housing, which are likely to be less risky and have less investment flexibility.

Findings by Titman et al. (2005) suggest that property types are important in determining loan risk and credit spreads in the US. For example, relatively safe property types, such as multifamily apartment complexes and anchored retail properties, have higher LTV ratios and lower amortisation rates, while riskier properties, such as limited- and full-service hotels, have lower LTV ratios and higher amortisation rates. All of which impacts on final loan pricing and spreads.

For our analysis, we were only able to include loan pricing differences in office, retail and industrial property types; however, we are able to distinguish between prime and secondary property types, thus, overall, our findings generally confirm previous observations by Titman and Torous (1998).

Dietrich (2016) acknowledges the dearth of research on mortgage loan margins and significance of credit specific terms and uses data from eight small to large banks in Switzerland to study the impact of a number of factors on residential mortgage loan margins, defined as the difference between the nominal mortgage rate and swap rates. Three loan

specific characteristics – repricing (the period until interest rate is reset), the size of the loan and the year of loan advancement – are statistically significant determinants of interest rate margins. Lender specific features are also tested. The findings suggest that the size of the bank, annual growth of mortgage loans, a measure of operational efficiency (ratio of overhead expenses to average total assets) and the bank's credit quality (proxied by the ratio of loan loss provisions over total loans) are important differentiating features. In addition, this study finds that the money market rate, competition amongst lenders and the distinction between rural and urban areas are additional determinants of mortgage loan markets in Switzerland. However, residential loan markets and pricing are driven by different parameters as they are part of retail banking addressed to private individuals, the so-called B2C market. These loans are a mass product, not part of the same underwriting and risk criteria as commercial loans (B2B market) within the commercial bank. In addition, the UK lending market is also the most diverse market in Europe, with a large number of non-banks lending to real estate. The non-banks include insurance companies, pension funds and debt funds, which do not make the same type of annual performance information available nor do they record loss provisions in the same manner.

A study by Allen and Letdin (2020) looks at the cost of mortgage debt for REITs in the US, relating the borrowing rates to a group of REIT and loan attributes. For robustness purpose, the authors run the empirical analysis with the overall sample of REITs and controlling for REIT credit rating, share of institutional ownership and analyst coverage (number of analyses providing NAV coverage). In all these variations of the empirical analysis, the variable secured debt (collateral is offered to the lender) is highly significant and takes a positive sign (cost of mortgage debt is higher for collateralised loans). Another statistically significant variable across the board is the loan amount, with the remaining term of the loan receiving empirical support in some specifications. REIT profitability, leverage, size of the REIT and

cash holdings are not significant. Perhaps these effects are carried on by the fixed effect control at company level. Other control variables in this study are the type of property and the 30-year mortgage rate. This study also finds that a higher percentage of shares held by insiders (in relation to total shares) increases the cost of debt. Whilst there is some limited secured corporate borrowing by European/UK property companies or REITS, these entities are not rated and our analysis does not include secured corporate debt, which is covered by different lending criteria.

Further insight is gained from the more general loan pricing framework based on RAROC (risk-adjusted return on capital) proposed in the work of Aguais et al. (1998), Aguais and Santomero (1998) and Aguais and Forest (2000), These studies address the issue of risk adjusted pricing under different capital requirement regimes (such as Basel II/III, IV). However, one weakness is that important practical aspects in commercial loan pricing, such as the impact of the type of lender, or geographical location, are not covered in the real estate literature.

Another examination by Black et al. (2012) of US commercial mortgage loans finds there is considerable heterogeneity in the organisational structures of CMBS loan originators, which may influence originators' underwriting incentives. They find significant differences in the propensity to become delinquent depending upon whether a loan was originated by a commercial bank, investment bank, insurance company, finance company, conduit lender, or foreign-owned entity. These differences hold both before and after controlling for key loan characteristics.

Finally, another link to overall return is made by Lepetit et al. (2008a; 2008b) for a set of European banks, which shows that banking risk is mostly located in small banks and is caused by commission and fee generating activities. The findings of Demirgüc-Kunt and

Huizinga (2010) indicate that an expansion into non-interest income-generating activities increases the rate of return on assets (ROA), while wholesale funding lowers the ROA.

However, one could say that type of lender is implicitly linked to different capital requirement regimes leading to different returns and return requirements. Few studies have focused on commercial real estate lending when it comes to research on capital requirements. The Basel II/III reforms have led to considerable heterogeneity in capital requirements both across and within lenders, which has created different market opportunities for different lenders in one market. Different methodologies for setting risk weights co-exist in the same market under Basel II & III. The "internal ratings based" (IRB) approach, as the use of internal models is more formally known, is costly to set up and manage. So, while most of the largest lenders have adopted IRB, smaller banks tend to rely on the simple metrics set by regulators, formally known as the "standardised approach" (SA). For example, Benetton et al. (2015) find that this divide in IRB models causes lenders to specialise, which leads to systemic concentration of high-risk mortgages in lenders with less sophisticated risk management. This is an important observation and means that loan pricing is, amongst other things, driven by the business model and underwriting capability of the lending institution. In a recent paper, Bennetton (2021) confirms that average risk weights fell more for lender who adopted the IRB approach versus those using the SA approach. The choice was often due to lender size, economies for scale, with larger banks adopting the IRA approach .The size of this IRB-SA gap was also larger for lower LTV ratios.

3. Methodology

There are many parameters reflected in the final loan price, which covers all costs and adequately compensates for the risks associated with the loan. For bank internal purposes, it is important to split the loan price into its components, i.e. which part of the loan margin

reflects funding costs or expected losses. We use the risk-adjusted loan price where the loan is priced using a fixed spread over a floating benchmark such as LIBOR and the risk-adjusted price is the spread between the loan price and the risk-free rate. This all-in credit spread is assumed to indicate the level of risk of the loan, without distinguishing various internal funding costs. The theoretical model of credit spread variation in this study includes factors that determine the all-in-spread with existing studies providing guidance for which variables to include. We should note that the structure of the model is also driven by the empirically collected data through the survey.

Equation (1) gives the general theoretical specification that relates the loan spread to five risk factors:

$$Loan\ credit\ spread_{i,j,t} = f(asset, origin, type, LTV,\ region, size) \quad (1)$$

where:

$loan\ credit\ spread$ (LCS) is the spread of the loan for asset i, by lender j at time t.
$asset$ is the asset (property) type
$origin$ is the lender origin
$type$ is the type of lender
LTV is the loan to value ratio
$region$ is the regional loan exposure
$size$ is the size of the loan

We deploy a panel regression approach to investigate the impact of individual lenders' business models and loan characteristics on credit spreads. We estimate a number of panel models to incrementally assess the impact of the likely determinants of spread discussed earlier (see equation (1)). Equation (3) illustrates the panel regressions we estimate:

$$LCS_{ijt} = \alpha + b_k Z_k + e_{ijt} \quad (2)$$

Z_k refers to the five (k=5) determinant factors of the loan credit spread we examine. e is an i.i.d error. The intercept α is allowed to vary by loan (fixed effects). Two important variables measuring the quality of the underlying assets and their location are not included due to data availability. To a degree, the cross-section fixed effects capture these risk factors but still their impact is not fully conveyed. Further variables, such as underwriting ratios (interest rate cover ratio, debt-service cover ratio), would be of interest but there are data limitations. Again, we expect that fixed effects should in part control for unobserved effects of the debt service coverage ratio and the interest coverage ratio. Model (2) is also estimated with time effects. We use time-demeaned panel regression and the standard errors are clustered at the lender level. A further extension is to allow the intercept to vary across different time periods – a two-way fixed effects model. In the random effects model all three components (intercept, time specific and cross-sectional error components) are assumed random and not fixed. We are especially interested in time effects on loan pricing and we examine the impact of the causal factors on loan pricing pre and post GFC.

4. Variables and data description

The research uses a unique data set that has been collected through a survey of lending institutions presenting portfolio level data of loan portfolios by different lenders in the UK actively lending during 2004 – 2018 on an annual basis. The aggregated lending data collected include loan pricing offers and other loan terms for different property types and typical loan size originated by lender.

In the survey, lending organisations are asked regarding terms they would offer for an interest hedged bilateral loan secured against a new, high specification rack rented building situated in what they consider to be a prime/secondary location let on institutionally accepted terms to a tenant of undoubted covenant for a term certain of 10 years. This information is

compiled for the following property types: prime and secondary office, retail and industrial assets. Further lenders supply this information for maximum LTVs ranges, 40%, 50%. 60%, 70%, 80% and 90%. Appendix A illustrates the questionnaire used in the survey. In total, our sample includes 139 institutions lending on secured commercial mortgages.

(i) Loan credit spread (LCS)

Loan pricing information reflects price quotes received for standardised loans by several lenders in the market, as explained in the previous paragraph; as such, they offer prices at which level borrowers can expect to obtain financing for specific types of projects. These may differ from the contractually agreed loan price after full credit approval.

Pricing terms are quoted for a specific LTV level and property type, including margin, ICR/DSCR covenant levels required, arrangement fees and amortisation terms. The typical loan term is five years, but, depending on the day-one LTV level, the loan might be interest only or have some limited amortisation, usually ranging from 3-5% over a period of five years. We define the loan credit spread (LCS) as

$$LCS_{i,j,t} = \left(margin_{i,j,t} + libor_t\right) - gilt_t \qquad (3)$$

The spread ($LCS_{i,j,t}$) is a function of margin for asset i, by lender j, at time t ($margin_{ijt}$), plus the three-month Libor rate for that period ($libor_t$) less the gilt rate over the same tenor at the corresponding period ($gilt_t$). The loan spread is measured in basis points.

Widening credit spreads indicate growing concern about the ability of corporate (and other private) borrowers to service their debt. Narrowing credit spreads indicate improving private creditworthiness.

Figure 1 shows the average historic loan spread across all property types. The 5-year gilt rate shows the effect of quantitative easing in 2008, when gilts rates dropped substantially, and

then for the second monetary policy intervention in 2012. During the first drop in gilt rates in 2008 loan pricing also dropped due to the change in variable interest rates.

Figure 1 Average historic loan spreads

The data collected from each lender include loan portfolio information on their regional distribution, LTV ranges, type of projects financed and maximum loan sizes. Between the different periods prior to GFC and post-GFC, the spread moved from an average of 162bps to 235bps post-GFC, indicating that overall conditions changed between the two different periods.

(ii) Property asset type

Different loan spreads (LCS) are also linked to different property types, as existing studies have indicated (e.g. Titman et al., 2005)). Our data sample includes loan pricing terms for different property types distinguishing to some extent differences in credit quality such as mortgages secured on prime office property versus mortgages secured by secondary office property, with prime property assumed to be of higher credit quality. Hence, for secondary property of lower credit quality, the widening of credit spreads may indicate a growing concern about the ability of borrowers to service their debt. While narrowing credit spreads would typically indicate improving creditworthiness, it could also raise concerns over adequate risk pricing if one asset class suddenly experiences narrowing credit spreads in comparison to other similar assets.

Property types included in the analysis are office, retail, industrial and residential investment property in prime and secondary cities. While there is information on alternative asset types, such as hotels, the data set is still very limited. Hence, this analysis only concentrates on the main property types. In the UK, investors' perception of property systemic risk differs from

the US. Overall, the safest property class is considered to be prime office, followed by residential property. Retail property in the UK is considered more volatile than in the US whilst industrial property is a niche property class which typically attracts higher yields. Operating properties with no fixed NOI , such as hotels, student housing, pubs and casinos, are considered speciality property, which requires special management knowledge; therefore, they are a niche class associated with higher risk. Figure 2 shows the historic loan pricing margins, which are priced over 3-month Libor for the main property types. While during the pre-GFC period there was little to no differentiation in risk pricing between different property types, the post-GFC period shows changes in the pricing behaviour with regard to property types.

Figure 2 Loan margins by property type

Figure 2 shows the compression of margins up to 2006 followed by the increase in loan spreads from 2008 onwards and the turning point in 2012. The historic UK loan pricing data by property type show that secondary property loans are priced significantly above loans against prime property and some distinction is made between property types – office, retail, industrial - such as discussed above.

(iii) Lender origin

The distinction by lender types serves the analysis of our hypothesis that loan pricing differs by lenders' business types and regulatory regime. The UK lending market has a diverse set of real estate lenders, including foreign banks, insurance companies, pension funds and other alternative lenders. Between 2004 and 2018, the data included 30% UK banks, 18% German

banks, 20% international banks, 5% North American banks, 12% insurance companies, and 15% debt funds. Insurance companies and debt funds are not regulated in the same way as banks and compete against bank lenders on loan pricing.

Due to the diversity of lenders in the UK, banks and other lenders are identified first by their country of origin. The country of origin serves as a proxy for the regulatory regime the lender is controlled by.

- Origin 1: UK banks
- Origin 2:German banks
- Origin 3:International banks
- Origin 4:US banks

The way each bank finances itself depends on regulatory requirements, which can differ by country. For example, German banks may manage large covered bond programmes, which allows them to include various property assets into the cover pool and, hence, lowers their loan pricing substantially from those who do not benefit from covered-bond issuance programmes. We have classified each lender according to the country of the location of their headquarters, for example, Deutsche Bank is classified as a German bank and Santander as an international bank. On the other hand, HSBC group with its head office in London is classified as a UK bank.

Regulatory supervision has also driven banks to adopt different internal rating and risk models to determine their capital requirements. Since Basel II was introduced in 2008, two approaches to calculating bank capital requirements have co-existed: lenders' internal models, and a less risk-sensitive standardised approach (SA). All UK banks are subject to a standardised prescribed slotting approach, while non-UK banks may apply their own internal models, including advanced IRB (internal ratings-based approach) and standardised IRB.

This has arguably resulted in arbitrage opportunities between lenders in loan pricing not immediately visible or known to the borrower. Our model will show that lenders do not always have a competitive advantage over foreign lenders to lend in their home country.

(iv) Type of lender

While country of origin is a good proxy for regulatory supervision, we postulate that large and supposedly more sophisticated lenders have access to more efficient IRB pricing models. In order to reflect these differences, our model distinguishes between types of lending institutions. We classified entities as commercial, investment, mortgage bank or regional bank. Investment banks are financial services companies that act as intermediaries in large and complex financial transactions and do not have large own balance sheets available backed by cash deposits. Commercial banks accept deposits, offer checking account services, make various loans, and offer basic financial products like certificates of deposit (CDs) and savings accounts to individuals and small businesses. A commercial bank is where most people do their banking. Mortgage banks primarily or exclusively offer loans to clients to purchase real estate, especially of private residences. The bank loans its own capital to clients and either collects payments (with interest) or sells its loans on the secondary market. Its typical business is not to collect deposits from clients. Regional banks may be concentrated in one region with a few branches; they may not offer the full-service range of retail banking and corporate banking due to their size. Each of these distinctions means that the bank applies for different regulatory models and treatment for different divisions and products within the bank.

Table 1 Type of lending institution

When classifying the data set by type of lender, the majority of lenders were commercial banks with a share of 26%, and a further 18% were specialised mortgage banks. This

classification provides an insight of the different strategies of each lender; for instance, investment banks originate loans to distribute afterwards in the secondary market or via securitisation, while commercial banks hold the loan on their balance sheet to earn all fee income themselves. Funds typically have different target IRRs depending on their investment strategy. Retail banks benefit from a large branch network and might refer retail clients to their commercial lending teams, while regional banks only serve a specific region where they might be the local dominant lender in the market. Overall, the data on lender types allow us to study clientele effects by constructing variables corresponding to average mortgage characteristics per lender. In our final model, we have combined country of origin and business models into 10 categories, reflecting the dominant types for each region present in our sample.

- UK commercial bank
- UK mortgage bank
- UK regional retail bank
- German commercial bank
- German mortgage bank
- International retail bank
- International commercial bank
- Investment bank
- Insurance
- Debt fund

(v) LTV ratio

Higher margins are associated with higher LTV lending, reflecting the higher risk in higher LTV loans. Titman and Torous (1989) denote that properties with higher NOI to asset value ratios have mortgage loans with higher LTV ratios. One explanation for this observation is that a higher NOI to asset value ratio permits the borrower to satisfy debt coverage ratios with

mortgages with higher LTV ratios. The higher amortisation rate can be explained by the fact that properties with higher NOI to value ratios are likely to experience less income growth and may be riskier. While it is true that higher yielding properties can sustain a higher level of debt, often allowing for mezzanine lending ranking behind a senior loan, average LTV by property types shows that LTV ratios are generally lower for secondary property than for prime. In our investigation, the LTV is a key risk factor determining loan spreads and we would expect a positive impact on loan spreads.

(vi) Region

In order to examine any specialisation effects, we include geographic loan exposure, loan size and LTV ratio by asset type into our model. Lenders' loan portfolios can be split by geography into portfolios with a proportion of loans in:

- Central London
- South East UK
- North England
- Midlands
- Scotland
- Portfolio across UK

Approximately half of all loan portfolios are located in London and the rest of the UK South East, these reflect the most prosperous regions of the UK with the highest concentration of lenders

(vii) Size (MaxLoan)

Our last variable to test is loan size. We don't have information of the specific loan size of each deal, thus we use the maximum loan reported for each period by lenders as a proxy. We test the hypothesis that bigger loans attract smaller margins (inverse relationship).

5. Results and discussion

Our first models (columns 1 &2 in Table 2) test the differences in credit spreads for different asset types and our key variable LTV with year and lender fixed and non-fixed affects. First, we examine how LTV and property type affect the credit spread. All specifications are estimated with time (yearly) fixed effects.

As shown in columns 1 & 2 in Table 2, the LTV ratio has a significant positive impact on credit spread, showing that an increase in LTV ratio by 1%, will result in a credit spread increase by 33.6 bps. This finding is in accord with existing research results (see Titman et al. 2005). The LTV ratio per lender has a strong positive relationship with credit spreads, which is consistent with the idea that lenders specialise in mortgages with either high or low levels of risk, and that high LTV mortgages require substantially higher spreads.

We further find that lenders did differentiate the credit risk of different asset types. For example, prime office loans are priced significantly below those of other asset types. There is also a distinction between secondary and prime assets. This confirms existing findings from the US market.

Examining the effect of different asset types, we find that loan pricing spread is significant for most property types. Loans secured by prime office property are priced lower by 43bps on average, indicating the prime office loans are less risky. As for loans secured by primary retail properties, the credit spread is narrower with 33bps and primary industrial properties have an even lower spread by 19bps. On the other hand, secondary offices, secondary retail and secondary industrial properties all have higher spreads, which indicates higher risk due to their secondary nature

In the specification of column 2 in Table 2, we add lender fixed effects. The improved R square suggests that a better way to model the data would be to allow each lender group (business

type) to have its own intercept. The two-way fixed effects model is used to obtain the estimates in column 2. We find that the coefficients retain their order of significance, which further indicates the robustness of our results.

As mentioned previously lenders are exposed to different regulatory regimes and internal risk models. Our classification of lender types and business models tries to take specifically these differences into account. Table 2 column 3 shows the impact of 10 lender types.

Using UK commercial banks as a benchmark, results show significant differences in loan pricing for UK mortgage banks and regional retail banks. Especially UK regional retail banks price their loans 93bps above UK commercial banks, which is consistent with other empirical findings and assumptions that commercial banks have more sophisticated models and better access to highly trained staff as well as access to better borrowers. They are typically also large in terms of size of total assets. The same assumption applies to international retail banks, which price loans with a 42bps premium. While German commercial banks showed low significant differences with UK commercial bank pricing, German mortgage banks clearly present the lowest loan pricing with 31bps below UK commercial banks. Also, significantly different was the pricing from debt funds, which is amongst the highest with 58bps above UK commercial banks. Investments banks, who arguably have access to securitisation and other distribution, did not offer significantly different pricing neither did insurers and other international commercial banks.

Table 2 Panel regression output

We subsequently test the impact of regional exposure and loan size. As shown in column 4 in Table 2, compared to other regions, banks with a bigger share in Central London will have a lower pricing. Ceteris paribus, a 1% increase in Central London share, the bank will decrease

spread by 35bps on average. However, we find that regional effects on loan pricing are not significant at the 5% level.

Column 5 in Table 2 includes the impact of loan size. Because some of the banks do not report this information (MaxLoan), our number of observations is lower from the previous specifications. We find that negative coefficients, indicating that the bigger loans attract smaller margin. This verifies our primary hypothesis. But the coefficient is not statistically significant, which may due to data limitations and the imperfect proxy MaxLoan.

We seek more insight on the relationships and we repeat the analysis for two distinct time periods: a) the period leading up to the crisis including the crisis period 2004 – 2011 and b) the post-crisis period 2012 – 2018, respectively. The global financial crisis triggered changes in the lending environment and risk assessment processes, hence it is expected to - or at least should - be of interest to examine any differences in the relationships.

From the results reported in Table 3, it becomes apparent that pricing differentiation with regard to loan LTV has been significant in loan pricing for the post-crisis period. However, during the earlier period, lenders made little distinction in pricing different LTV risk (Table 3, column 1). Especially in the period from 2012 – 2018, further pricing differentiation was made between loan pricing for loans secured for primary versus secondary assets. Loans secured against secondary retail assets were priced on average 56bps higher and secondary industrial 50bps. This shows further the changes and effectiveness of regulatory pressure on lenders' loan pricing for specialist assets.

Table 3 Pricing effects pre- and post-crisis

When examining the differences between lender types on loan pricing for both periods, results do not differ much from our previous findings. UK regional and mortgage banks show

higher pricing compared to UK commercial banks and differences have widened significantly for the post-crisis period. The advantage of German mortgage bank loan pricing as well as German commercial bank loan pricing has also widened further in the post-GFC period, reflecting the generally higher capital burden for real estate lending.

A further change can be found when adding geographic portfolio aspects in combination with loan size. Portfolios concentrated in Central London achieve lower pricing compared to other regions. If the bank has a higher exposure (market share) in Rest SE, the spread will also decrease. Market power in other places, such as West/East, Midlands/Wales, North England and Scotland doesn't have significant difference in spread pricing. Our explanation is that, since 2012, lenders have concentrated their lending activity in London and the South East, which has significantly increased competition especially with new lenders entering the UK market or re-entering after the crisis. This has helped to suppress loan pricing in London loan portfolios.

6. Conclusions

In this investigation, we examine the significance and quantify the impact of a host of causal factors on mortgage loan spreads. We carry out the investigation with UK CRE lending data from 139 lenders active in the UK. The set of causal factors used encompasses both data on lender and loan characteristics. This work contributes to a largely under-researched area of the UK real estate finance market, in particular post the GFC. The study also aims to identify different patterns in the relationship between the commercial loan credit spread and the predictive factors before and after the GFC. To the best of our knowledge, this is the first study to explicitly seek evidence on the relationship of commercial property loans spreads and determining factors over these two distinct periods.

In summary, the empirical estimates, based on panel modelling, establish a significant negative impact of LTV to commercial mortgage loan spreads. Further the type of asset matters, with offices commanding a lower margin than retail, as well as the distinction between prime and secondary asset being financed, which is expected. Loans advanced in London carry lower margins than in the regions. This reflects the higher competitiveness of the London lending market in contrast to the regions, where less lenders are active. All three findings, loan pricing impact of LTV, regional pricing differences and pricing differences between property types, confirm findings from previous US market studies and are of no surprise.

This study also examines the impact of the internal risk model or capital requirement regime lenders have adopted to satisfy recommendations by the regulator. We proxy this determinant on loan spreads by classifying lenders to different types. The results show concerning differences in the loan margins applied by the different types of lenders. Regional UK retail banks and international retail banks price their loans above the benchmark UK commercial banks while German banks (commercial and mortgage), investment banks and insurance companies apply lower margins in relation to UK commercial banks. On the other hand, debt funds charge a higher loan margin. This clearly confirms that differences in regulation are leading to arbitrage opportunities for borrowers and creating an unequal ending market.

The analysis pre- and post-GFC reveals two changes. Firstly, the significance and impact of LTV has risen post-GFC. This is an important point as it demonstrates the impact of regulatory changes on LTV. With the new Basel rating models, lenders had to recalibrate their models, resulting in loans with higher LTVs attracting higher capital charges. The same can be said for the Bank of England slotting model, which penalises loans with high LTVs. Secondly, the margin on mortgage loans to London commercial assets has fallen, reflecting the perception that London carries fewer risks to the lender. The latter is explained by the

highest concentration of lenders and the high competition of lenders in the London market, which has been driving loan pricing down in London versus other UK regions.

Using UK data, this study confirms the results of empirical work in the US. We acknowledge the importance of broader risk factors such as cyclical market effects on loan pricing, as they have been documented in the standing literature. We have conducted our panel analysis with time effects to control for general economic, monetary and real estate market conditions.

This study quantifies a set of determinant variables on commercial loan pricing and it can, therefore, be used as a framework to calculate a fair value for commercial loan margins. From the borrower's perspective, the results identify what factors are priced when seeking a loan. We also view this study as a structure to incorporate additional fundamental influences in the determination of commercial mortgage loan spreads with the ultimate aim of spotting risks from actual loan spreads being lower than fundamental based spreads, pointing to over-lending. Especially, we raise the point that differences in loan pricing are determined by lender business models, irrespective of the risk assessment of the underlying asset, the LTV and regional location of the asset. More research has to be carried out to quantify the impact of different national regulations on loan pricing.

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APPENDIX A: Excerpt from Commercial Real Estate Lending Survey

This question relates to lender's debt lending strategy applied to a PRIME OFFICE property

What terms would you offer for an interest hedged bilateral loan secured against a new, high specification rack rented building situated in what you consider to be a prime location let on institutionally accepted terms to a tenant of undoubted covenant for a term certain of 10 years?

Maximum Loan to Value ratio	Interest rate margin*	Amortisation rate	Arrangement fees (and exit fees if applicable)	Target internal rate of return for Junior debt or Mezzanine
90%				
85%				
80%				
75%				
70%				
65%				
60%				
55%				
50%				
45%				
40%				

*Please state benchmark over which margin is charged

This question relates to your debt lending strategy applied to a SECONDARY OFFICE property

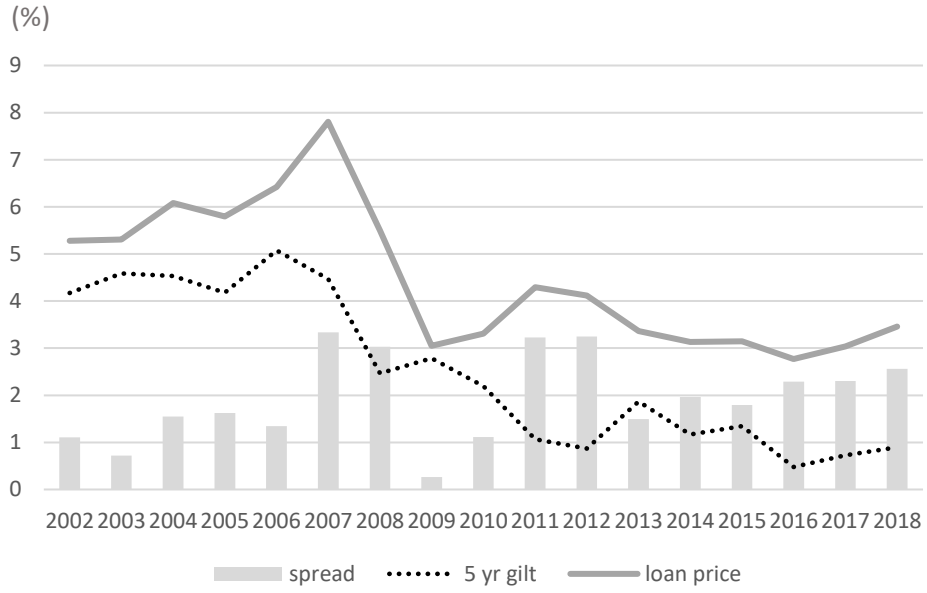
What terms would you offer for an interest hedged bilateral loan secured against a 20 year old rack rented building situated in what you consider to be a secondary location let on institutionally accepted terms to a tenant of BBB covenant for a term certain of 10 years?

Maximum Loan to Value ratio	Interest rate margin*	Amortisation rate	Arrangement fees (and exit fees if applicable)	Target internal rate of return for Junior debt or Mezzanine
90%				
85%				
80%				
75%				
70%				
65%				
60%				
55%				
50%				
45%				
40%				

*Please state benchmark over which margin is charged

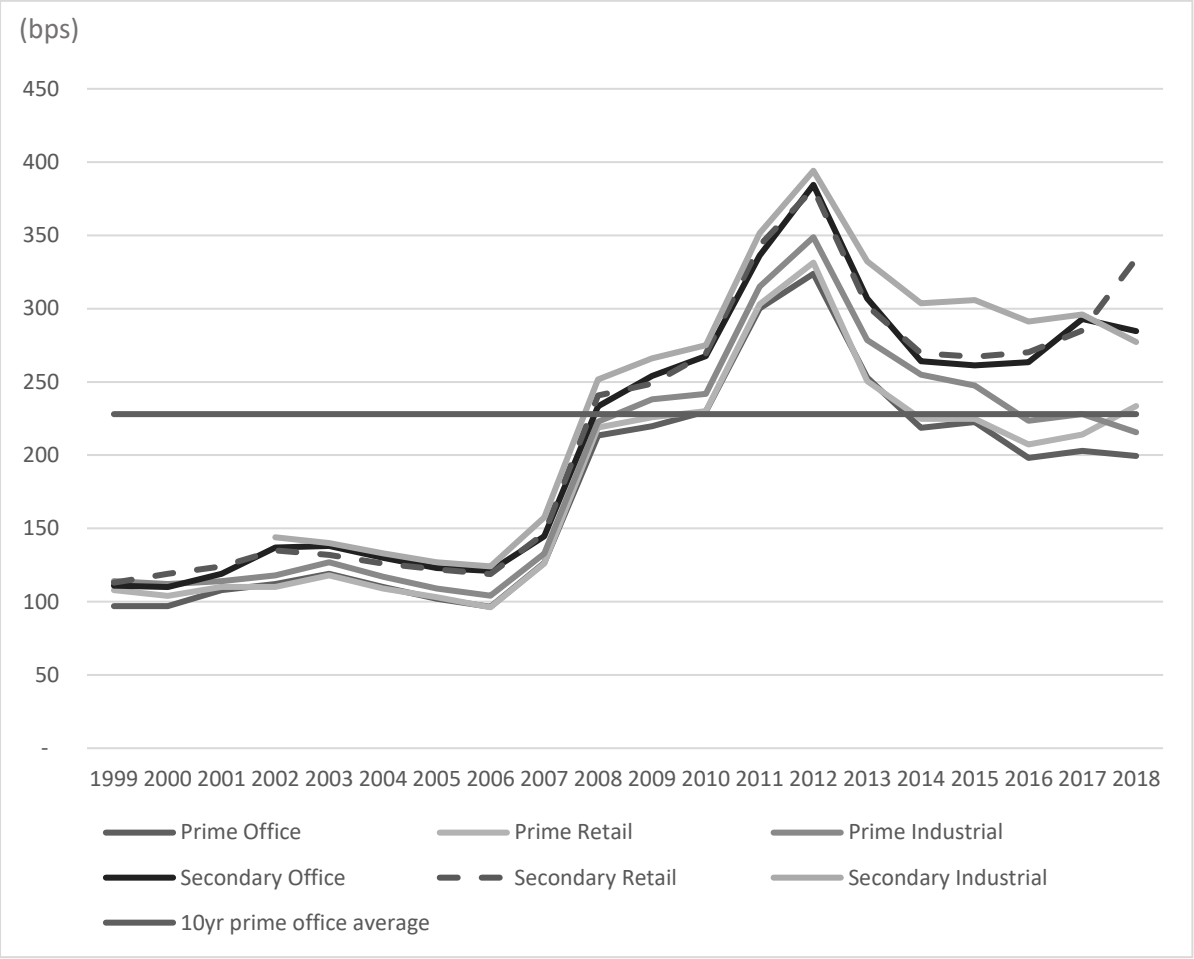
Similar information is obtained for prime retail, secondary retail, prime industrial and secondary industrial. The survey is filled by different types of lender as described in Table 1. The loan pricing terms of lenders are updated every six months resulting in a continuous series.

Figure 1 Average historic loan spreads



Source: Bloomberg, Bayes CRE Lending Survey

Figure 2 Loan margins by property type



Source: Bayes CRE Lending Survey

Table 1 Type of lending institution

Type of lender	Share of total
Commercial bank	26%
Mortgage bank	18%
Retail bank	13%
Investment bank	12%
Insurance	12%
Small fund	8%
Large fund	7%
Regional bank	5%
Total	100%

Source: Bayes CRE Lending Survey

Table 2 Panel regression output

Model	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Variable name	spread	spread	spread	spread	spread
LTV	336.3***	169.6***	276.1***	319.7***	321.9***
	(56.23)	(41.82)	(45.26)	(47.49)	(46.69)
Prime office	-43.03***	-22.17***	-33.95***	-32.31***	-31.12***
	(7.970)	(4.370)	(7.090)	(9.971)	(11.37)
Prime retail	-33.33***	-13.41***	-24.73***	-20.54**	-18.74*
	(7.609)	(4.362)	(6.728)	(9.642)	(10.91)
Prime industrial	-19.33**	-3.492	-10.52	-3.796	-2.054
	(7.754)	(4.369)	(6.566)	(9.269)	(10.14)
Secondary office	15.06*	20.07***	19.28**	30.92***	32.09***
	(8.369)	(5.363)	(7.525)	(10.40)	(11.50)
Secondary retail	18.60**	27.43***	24.14***	40.72***	42.61***
	(8.266)	(5.921)	(7.362)	(10.09)	(11.18)
Secondary industrial	29.00***	33.92***	32.36***	50.91***	55.24***
	(8.746)	(6.026)	(7.991)	(11.39)	(12.71)
UK Mortgage bank			20.95**	21.00*	15.45
			(9.832)	(11.78)	(14.61)
UK Regional bank			92.85**	177.1***	167.6***
			(40.92)	(45.29)	(42.01)
German commercial bank			-15.48*	-13.52	-19.55
			(8.154)	(11.14)	(13.44)
German mortgage bank			-31.23***	-37.53***	-45.92***
			(8.522)	(12.99)	(13.95)
International retail bank			41.71**	61.03**	62.15**
			(19.63)	(26.77)	(26.78)
International commercial bank			2.746	8.891	6.847
			(13.01)	(20.97)	(25.35)
Investment bank			-0.868	-0.940	-2.147
			(7.824)	(12.01)	(15.64)
Insurance			-10.01	-8.048	-11.12
			(9.331)	(14.13)	(14.10)
Debt Fund			58.10***	67.64***	80.31***
			(18.97)	(24.43)	(29.65)
CLondon				-35.20	-63.15*
				(30.11)	(36.09)
Rest of South East				-47.46	-87.35*
				(38.48)	(44.34)
West England				-3.198	-156.9
				(137.6)	(137.6)
Midlands&Wales				47.55	45.21
				(45.54)	(43.41)
North England				-22.65	-6.190
				(52.20)	(53.04)
Scotland				-19.41	-84.87
				(41.53)	(83.63)
MaxLoan					-0.0135

					(0.0331)
Constant	-4.283	91.42***	21.06	30.46	68.16
	(34.75)	(28.79)	(29.49)	(38.42)	(40.95)
Observations	4,237	4,235	4,237	2,338	1,983
R-squared	0.629	0.859	0.701	0.693	0.648
Year FE	Yes	Yes	Yes	Yes	Yes
Lender FE	No	Yes	No	No	No

**** p<0.01, ** p<0.05, * p<0.1, robust standard errors in parentheses*

Table 3 Pricing effects pre and post crisis

Model	(1)	(2)	(3)	(4)
Variable name	spread	spread	spread	spread
LTV pre GFC	-63.16*	-37.21	-50.40	-60.65
	(32.99)	(33.37)	(82.34)	(95.16)
LTV post GFC	324.7***	407.9***	388.3***	386.1***
	(58.03)	(62.79)	(97.57)	(110.1)
Prime office pre GFC	-20.00***	-25.69***	-38.50***	-40.04***
	(3.551)	(4.146)	(8.739)	(9.556)
Prime office post GFC	-0.0430	-2.600	12.85	14.32
	(6.591)	(9.768)	(12.55)	(13.69)
Prime retail pre GFC	-19.74***	-24.92***	-34.64***	-35.93***
	(3.352)	(3.967)	(8.194)	(8.792)
Prime retail post GFC	14.64**	10.79	22.23*	23.61*
	(6.652)	(9.498)	(12.11)	(12.91)
Prime industrial pre GFC	-13.89***	-17.68***	-24.14***	-27.21***
	(3.459)	(4.164)	(7.348)	(8.501)
Prime industrial post GFC	18.36***	19.75**	28.64**	32.11**
	(6.301)	(9.184)	(11.36)	(12.38)
Secondary office pre GFC	-1.980	-3.789	-9.198	-9.988
	(3.557)	(4.147)	(6.985)	(9.069)
Secondary office post GFC	38.60***	40.33***	47.91***	47.39***
	(8.136)	(10.67)	(13.13)	(15.01)
Secondary retail pre GFC	-2.134	-3.962	-6.119	-5.426
	(3.536)	(4.114)	(7.282)	(9.348)
Secondary retail post GFC	56.66***	55.15***	56.96***	54.43***
	(8.538)	(10.12)	(12.89)	(14.59)
Secondary industrial pre GFC	4.542	1.795	2.857	7.553
	(3.991)	(5.078)	(8.328)	(9.912)
Secondary industrial post GFC	50.18***	51.14***	56.04***	52.10***
	(9.521)	(11.96)	(14.44)	(16.82)
UK mortgage bank pre GFC		15.40***	17.59	46.51**
		(4.651)	(16.42)	(20.15)
UK mortgage bank post GFC		41.01**	25.36	-29.47
		(16.80)	(30.57)	(29.19)
UK regional bank pre GFC		25.51*	-12.99	38.54
		(12.98)	(20.32)	(27.81)
UK regional bank post GFC		170.3***	233.9***	159.2***
		(60.37)	(46.95)	(50.37)
German commercial bank pre GFC		0.934	20.96	12.69
		(8.320)	(16.37)	(21.38)
German commercial bank post GFC		-27.65***	-50.96***	-46.44**
		(8.568)	(12.39)	(19.80)
German mortgage bank pre GFC		-16.64***	-13.20	-20.55
		(5.013)	(16.57)	(21.57)
German mortgage bank post GFC		-37.47***	-39.58**	-41.66*
		(7.536)	(17.54)	(22.55)
International retail bank pre GFC		36.62***	26.89	66.85**
		(11.08)	(18.00)	(26.47)
International retail bank post GFC		21.03	43.58	-7.300

		(37.64)	(31.81)	(36.01)
International commercial bank pre GFC		15.92*	27.16	76.51***
		(8.622)	(20.43)	(26.40)
International commercial bank post GFC		-17.98	-26.87*	-84.06***
		(12.74)	(14.92)	(18.04)
Investment bank pre GFC		5.307	-14.08	-12.59
		(5.436)	(22.00)	(24.67)
Investment bank post GFC		-1.300	14.91	11.68
		(10.50)	(20.74)	(23.46)
Insurance pre GFC		-1.812	-26.16*	-8.921
		(8.138)	(13.25)	(20.02)
Insurance post GFC		-3.407	21.07	-2.545
		(12.32)	(15.14)	(18.96)
Debt fund pre GFC		32.87***	87.57***	190.1***
		(12.01)	(14.68)	(22.22)
Debt fund post GFC		35.79	-22.67	-117.6***
		(25.13)	(27.79)	(35.22)
Central London pre GFC			-16.98	-56.29**
			(32.12)	(26.46)
Central London post GFC			-10.55	12.47
			(40.70)	(44.96)
South East UK pre GFC			-44.40	-134.7***
			(29.17)	(42.02)
South East UK post GFC			5.935	70.30
			(49.29)	(64.35)
Midlands & Wales pre GFC			-1.002	-44.71
			(40.64)	(32.01)
Midlands & Wales post GFC			35.45	101.2*
			(59.53)	(60.05)
North UK pre GFC			68.37	58.68
			(51.44)	(55.32)
North UK post GFC			-67.05	-42.78
			(58.25)	(61.39)
Scotland pre GFC			-42.90	-392.0***
			(51.93)	(140.9)
Scotland post GFC			57.81	378.6**
			(69.66)	(162.9)
MaxLoan pre GFC				0.195***
				(0.0458)
MaxLoan post GFC				-0.234***
				(0.0490)
Constant	143.6***	94.10***	62.25*	85.00**
	(20.41)	(18.56)	(33.49)	(37.96)
Observations	4,235	4,237	2,338	1,983
R-squared	0.872	0.763	0.732	0.692

**** p<0.01, ** p<0.05, * p<0.1 , robust standard errors in parentheses*