Determinants of Credit Spreads in Commercial Mortgages

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ABSTRACT

This paper examines the cross-sectional and time-series determinants of commercial mortgage credit spreads as well as the terms of the mortgages. Consistent with theory, our empirical evidence indicates that mortgages on property types that tend to be riskier and have greater investment flexibility exhibit higher spreads. The relationship between the loan to value (LTV) ratio and spreads is relatively weak, which is probably due to the endogeneity of the LTV choice. However, the average LTV ratio per lender has a strong positive relation with credit spreads, which is consistent with the idea that lenders specialize in mortgages with either high or low levels of risk, and that high LTV mortgages require substantially higher spreads. Finally, we observe that spreads widen and mortgage terms become stricter after periods of poor performance of the real estate markets and after periods of greater default rates of outstanding real estate loans.

I. Introduction

Commercial mortgages provide perhaps the best setting for examining default spreads in the fixed income market. In most cases, commercial properties have only one outstanding loan, the loans generally are not prepayable without substantial penalties, and assets that are relatively easy to evaluate collateralize the loans. There is currently more than a trillion dollars of commercial mortgages outstanding and the market is growing, both in the United States and around the world.

This paper empirically examines the determinants of credit spreads for commercial mortgages; i.e., differences between mortgage rates and Treasury Bond rates with the same maturities. Using a data set of 26,000 individual commercial mortgages that were originated between 1992 and 2002, with the intent of being included in a commercial mortgage backed security,[1] we examine cross-sectional differences in mortgage spreads, as well as time-series fluctuations in average spreads.

Our cross-sectional tests are motivated by theoretical pricing models developed by Titman and Torous (1989), Kau, Keenan, Muller, and Epperson (1990), and Titman, Tompaidis, and Tsyplakov (2004). The earlier papers present models that indicate that mortgages on properties that are more volatile and that have higher payouts tend to have higher spreads. The more recent Titman, Tompaidis, and Tsyplakov (2004) model shows that mortgages on properties with more investment flexibility; i.e., properties that can be expanded or renovated, should also have higher spreads.

Our empirical results are largely consistent with these theoretical predictions. In particular, properties like hotels, which are likely to be both riskier and have the greatest investment flexibility, have significantly higher spreads than warehouses and multi-family housing, which are likely to be less risky and have less investment flexibility. In addition, credit spreads are positively related to the ratio of net operating income to property value (NOI/Value), which

[1] Such a commercial mortgage backed security, or CMBS, is called a conduit CMBS.

is also consistent with the models if we assume that a higher NOI/Value ratio is indicative of higher payouts.

The observed evidence on the relation between mortgage characteristics and spreads is somewhat less straightforward to interpret. Most notably, the loan to value ratio (LTV) of a mortgage is expected to be positively related to mortgage spreads, but our evidence on this is mixed. Similarly, we expect from theory that mortgage maturity should be positively related to mortgage spreads, but we empirically find the opposite. These violations of the theoretical expectations are likely due to the endogenous choice of mortgage characteristics with respect to the intrinsic risk of each mortgaged property, and hence mortgage characteristics are likely to proxy for unobserved risk attributes. Specifically, lenders are likely to require mortgages with higher downpayments; i.e., lower LTV ratios, and shorter maturities on properties that are likely to be riskier.[2]

To learn more about the endogeneity of the mortgage contract we examine the choices of individual originators. Our results indicate that different originators have different risk preferences; some originators attract riskier clienteles, attracting mortgages with higher LTV ratios as well as mortgages on properties that are riskier. Our analysis suggests that the above mentioned endogeneity problem is not nearly as severe when we examine average LTV ratios and average spreads across originators. Specifically, we find that the average LTV of the mortgages provided by originators is very strongly related to the spreads on those mortgages, which is consistent with the idea that spreads are strongly influenced by LTV ratios.

We also study the determinants of mortgage characteristics, such as the LTV ratio, the mortgage amortization rate, and mortgage maturity. Our results indicate that an important determinant of the LTV ratio and the amortization rate is the NOI/Value ratio. We find that

[2]Similar evidence is documented in studies of the default probabilities of individual commercial mortgages by Archer, Elmer, Harrison, and Ling (2002) and Ambrose and Sanders (2003). These studies find that the LTV ratios have low explanatory power for predicting default probability, which also suggests that the choice of LTV is endogenous. McDonald (1999) provides a theoretical model justifying the endogeneity of optimal leverage choice under uncertainty. He shows that default probability is the underlying factor in optimal leverage calculations.

properties with higher NOI/Value ratios have mortgages with higher LTV ratios and higher amortization rates. This finding indicates that a higher NOI/Value ratio permits the borrower to satisfy debt coverage ratios with mortgages with higher LTV ratios, while the higher amortization rate is in line with the lower slopes of the term structure of expected income on these properties as well as the increased risk of the mortgages. In addition, we find that relatively safe property types, such as multi-family apartment complexes and anchored retail properties have higher LTV ratios and lower amortization rates, while riskier properties, such as limited and full service hotels have lower LTV ratios and higher amortization rates.

In addition to our cross-sectional analysis we examine the time-series variation in spreads and mortgage characteristics. Consistent with the analysis in Titman and Torous (1989) we find that mortgage spreads decrease with increases in Treasury Bond rates. Moreover, our results indicate that not only do higher interest rates lead to lower spreads, but average LTV ratios decline as well, possibly due to the higher interest payments or to binding debt coverage ratios. We also find that spreads increase following periods when real estate markets perform poorly, which is consistent with the idea that the supply of mortgage capital declines when the financial institutions that provide the mortgages are financially weaker.

Our analysis is closely related to earlier work of Maris and Segal (2002) and Nothaft and Freund (1999) who studied the credit spreads of entire CMBS deals rather than individual commercial mortgages. Similar to our results, they find that CMBS spreads are affected by macroeconomic factors. In particular, Maris and Segal (2002) show that competitive pressure during the 1994-1997 period lowered underwriting standards, while the 1998 Russian default crisis weakened the commercial real estate lending market, leading to higher spreads. Nothaft and Freund (1999) find that spreads are negatively related to commercial property appreciation rates.

In addition to the previously mentioned mortgage papers, this paper relates to papers that examine yield spreads on corporate bonds. For example, Collin-Dufresne, Goldstein, and Martin (2001) examine empirically the determinants of changes in credit spreads of corporate

bonds. Eom, Helwege, and Huang (2004) provide the most recent and comprehensive study on this topic along with references to prior empirical work on the determinants of corporate bond spreads.

The remainder of the paper is organized as follows: In Section II we describe the data set. Section III introduces the explanatory variables, and discusses the cross-sectional determinants and time-series determinants of spreads of commercial mortgages. It also offers evidence of clientele effects. Section IV discusses the cross-sectional and time-series determinants of mortgage characteristics such as the LTV ratio, amortization rate and mortgage maturity. Section V summarizes the paper and discusses directions for future research.

II. Data Overview

Our data set, which was provided by Standard & Poor's, includes information on over 26,000 commercial mortgages. The mortgages originated between 1992 and 2002 with most of the originations taking place in the mid to late 1990s. The mortgages were later pooled and used as collateral for commercial mortgage backed securities (CMBS). All the mortgages in our sample were issued specifically for inclusion in a CMBS, and are referred to as conduit deals.[3] The value of the commercial properties collateralizing the mortgages varies from $60,000 to $725,000,000 and the aggregate value is approximately $250 billion. The mortgages were originated by more than 130 commercial banks, investment banks, insurance companies, and financing arms of large companies. The data set includes detailed information on

[3]In contrast to a Conduit CMBS, which includes mortgages that were originated with the intent of pooling them in a CMBS, other CMBS deals are labeled Portfolio, Large Loan, Fusion, Single Borrower, Franchise Loan, Agency, Credit Tenant Lease, and Floating Rate among others. Each of these CMBS deals focuses on particular types of loans; e.g., a Franchise Loan CMBS pool is made up of loans to franchised properties. Conduit deals are typically comprised of newly-originated mortgages, originated with the intent of being part of a CMBS deal, that conform to CMBS investor standards, and have lockout and yield-maintenance provisions (see Riddiough and Polleys (1999)). We have focused our analysis only on Conduit CMBS deals to avoid problems associated with the special nature of the loans included in the other CMBS types.

cross-sectional characteristics of individual properties and their mortgage contract specifications.

The property types in the data set include multi-family apartment complexes, unanchored retail, anchored retail, medical offices, industrial, warehouse, mobile home parks, office buildings, properties of mixed use, limited service hotels, full service hotels, and self storage. The most common type is multi-family apartment complexes, which represent 34% of the total number of properties. More than a third of the mortgaged properties in the data set are located in California, Texas and Florida.

Summary statistics are presented in Table I.

A. Mortgage Characteristics

The data includes the following financial information for individual mortgages: mortgage rate; loan to value ratio; origination date; whether the mortgage is balloon, amortizing, or semi-amortizing; whether the mortgage rate is fixed or adjustable; and the maturity of the mortgage.

The loan to value ratio (LTV) is measured as the loan amount divided by the appraised value of the property. Although the levels of the LTV ratio at origination vary from less than 10% up to 100% in this data set, more than 75% of the loans have LTV ratios between 60% and 80%. Multi-family apartment complexes and anchored retail properties have the highest LTV ratios, while limited service and full service hotels have the lowest. This pattern suggests that LTV ratios are endogenously chosen to account for the riskiness of each property type.

All the mortgages in the data set are fixed rate mortgages. Balloon mortgages represent approximately two-thirds of the mortgages with the rest being amortizing and semi-amortizing

mortgages. Among the amortizing mortgages, limited service hotels have the highest amortization rate, while office buildings have the lowest.[4]

The majority of the mortgages have 10 year maturities and, due to prepayment penalties, are effectively not prepayable.[5] Limited service hotels have the longest maturities, while the maturities do not appear to differ much for the remaining property types.

B. Originator Characteristics

We have information on the originator of the mortgage for 77% of our sample. From the mortgages on which we have information on the originator, approximately 58% are originated by commercial banks and investment banks including 16% by large investment banks, while the remaining mortgages are originated by insurance companies and financing arms of large companies. For the sample that includes information on the originator, twenty institutions originated about 65% of the mortgages. The number of mortgages per originator varies from 1 to 1,800, with 3 originators issuing more than 1,000 mortgages each. The data on originators allows us to study clientele effects by constructing variables corresponding to average mortgage characteristics per originator.

C. Property Characteristics

In addition to financial information, the data set includes information on individual properties at the time of mortgage origination. The information includes the appraised property value, the annual net operating income of the property, the property expenses over the previous year, the occupancy rate, the age of the property, the physical location and the property type.

[4]The loan amortization rate is defined as $1 - \frac{\text{Balloon Value}}{\text{Initial Principal Value}}$.

[5]Ambrose and Sanders (2003) and Fu, LaCour-Little, and Vandell (2003) find that commercial mortgages do prepay after a lockout period in ways that suggest that property owners are in fact acting opportunistically. There is no evidence that such behavior should affect mortgage spreads however.

The occupancy rate is defined as the percentage of square feet or units that is occupied or leased at the date of mortgage origination, or over a specified period prior to mortgage origination. Occupancy rates vary across property types with average occupancy of 98% for warehouses to average occupancy of 72-73% for full and limited service hotels.

The age of the properties at the mortgage origination dates ranges between 0 and 250 years, with an average age of 22 years and a median age of 17 years. The average age is approximately the same across different property types.[6]

The Net Operating Income (NOI) is defined as gross annual revenue less maintenance and other operational expenses before taxes and depreciation for the 12 month period prior to the mortgage origination date. It varies, as a percentage of appraised value, from 9.0% for anchored retail properties to 11.5% for medical offices. The expense to revenue ratio, which we assume provides information on the investment flexibility of a property, ranges from 18.6% for warehouses to 74.5% for medical offices.

[6]Our original dataset numbered close to 30,000 mortgages. Approximately 15% of the properties did not include information on either occupancy rate or property age. The mortgages corresponding to these properties have been removed from the data. We have verified that our results are robust to including these additional mortgages.

III. Cross-sectional and Time-series Variation of Credit Spreads

A. Cross-sectional Regression Specification

To capture the variation in credit spreads we first estimate a cross-sectional model for fixed rate mortgages using variables that correspond to property and mortgage characteristics. The model is specified by the regression equation

$$\begin{aligned} \text{Spread} = \text{intercept} &+ \sum a_i(\text{property characteristics variables})_i \\ &+ \sum b_i(\text{mortgage characteristics variables})_i \\ &+ \sum c_i(\text{property type dummy variables})_i \\ &+ d(\text{originator dummy variable}) \\ &+ \sum e_i(\text{quarterly time dummy variables})_i \\ &+ \varepsilon \end{aligned} \tag{1}$$

where the dependent variable, Spread is the difference between the mortgage rate and the rate on Treasury bonds with the same maturity as the mortgage, observed on the mortgage origination date.

The variables that describe property characteristics include the NOI/Value ratio, the property value, the occupancy rate, and the age of the property. The NOI/Value ratio proxies for the expected growth of net operating income. Specifically, properties with larger NOI/Value ratios are likely to have both higher payouts and lower NOI growth in the future, which in theory should increase credit spreads.

The value of the property captures size effects that can be associated with credit spreads for a variety of reasons. First, there may be economies of scale associated with lower transaction costs in providing a loan to a larger property. Second, larger properties may be associated with borrowers with greater reliability. Finally, bigger properties may also be more diversified and have more market power and hence be less risky.

We introduce the age of a property as a proxy for property quality. Older properties are likely to be of lower quality, and therefore provide the owner with the option to redevelop or to take steps to improve the property. As Titman, Tompaidis, and Tsyplakov (2004) emphasize, this flexibility option is likely to increase spreads. Since we expect that the age of a property does not affect spreads linearly, we use dummy variables for different age categories: less than 5 years old, between 5 and 15 years old, between 15 and 30 years old, and properties that are more than 30 years old.

The occupancy rate of a property can have either a positive or negative effect on spreads. On one hand, higher occupancy rates may increase spreads because occupancy rates are more likely to decline than increase when the occupancy rates are high. On the other hand, lower occupancy rates may be associated with riskier properties, or properties that offer greater investment flexibility for the borrower; both of these effects lead to higher spreads.

The variables that describe the mortgage are the LTV ratio, the amortization rate, and the mortgage maturity. Based on the contingent claims approach, the value of the LTV ratio should be positively related to the probability of default and the default spread, ceteris paribus. However, the LTV ratio is an endogenous choice that is determined after negotiations between the borrower and the lender. It is likely that lenders require greater downpayments; i.e., lower LTV ratios, for borrowers — or properties — that generate riskier cash flows. Therefore, it is likely that riskier properties have lower LTV ratios, which can attenuate or even reverse the positive relation between spreads and LTV ratios. We run regressions with different LTV specifications to determine how the endogeneity of the LTV choice affects our results.

The loan amortization rate and the mortgage maturity measure how fast the loan is paid off. Similar to the LTV variable, these variables are endogenously chosen; lenders may require higher amortization rates or shorter maturities for riskier properties. Since the effect of maturity of the mortgage on credit spreads is not likely to be linear, we use dummy variables for maturities less than 5 years, between 5 and 10 years and more than 10 years.

We use dummy variables for different property types in order to control for the differences in risk for each type of property. We expect properties that are less volatile and require less investment and maintenance, such as multi-family apartment complexes and mobile home parks, to have lower spreads than properties with volatile cash flows and higher maintenance and investment costs such as full and limited service hotels.

In order to capture whether the expertise of the lender matters, we introduce a dummy variable that characterizes the originator of a mortgage. This variable distinguishes whether the originator of the mortgage is a large investment bank. Investment banks such as Lehman Brothers, Merrill Lynch and Bear Stearns, among others, fall into this category.[7]

The dummy variables that correspond to the quarters of origination capture the effect of changes in the macro-economic environment on the mortgage spreads. We study them separately in Section III.D.

B. Cross-sectional Results

The results of our regressions are reported in Table II. Overall, the adjusted R-square is approximately 45% indicating that the variables explain a significant portion of the cross-sectional variation of the mortgage spreads. In the first specification (columns 1 and 2) of this table we include the LTV ratio as an independent variable. In theory, we expect mortgages with higher LTV ratios to have higher spreads. While the estimated coefficient of the LTV variable turns out significantly positive (columns 1 and 2 of the table), the second specification (columns 3 and 4 of the table) reveals that the result is not robust.

In the second specification (columns 3 and 4) we use, instead of a linear LTV variable, 6 dummy variables corresponding to different ranges of LTV ratios. This specification allows us to test whether the relationship between spreads and LTV ratios is monotonic. We find that

[7] Ambrose, Benjamin, and Chinloy (2003) find that bank originators have a different approach in assigning mortgage terms from non-bank originators. Ciochetti, Shilling, Deng, Lee, and Yao (2003) show that originator bias is important in estimating default probabilities.

spreads increase with LTV ratios for LTV ratios up to 70%, while they decrease as the LTV ratios increase beyond 70%. The mortgages with the lowest spreads overall have LTV ratios above 90%. These results indicate that the relationship between LTV ratios and mortgage spreads is complicated due to the endogeneity issue described earlier; i.e., that lenders require more risky borrowers to have lower LTV ratios.[8]

Based on the results from the second specification, in the last specification (columns 5 and 6 of Table II) we introduce a dummy variable for mortgages with LTV ratios above 70%. The results indicate that this variable is highly significant, and that, in addition, the positive relationship between the LTV variable and spreads is significantly strengthened.

The estimates of the other independent variables are not substantially affected by the specification of the LTV variable. In particular, we find that the coefficient of the NOI/Value ratio is significantly positive indicating that a higher expected growth rate in operating income leads to narrower spreads. Specifically, an increase in the NOI/Value ratio by 2% leads to an increase in spreads of approximately 1-2 basis points. This result is consistent with both the theory that suggests that properties with higher payouts should have higher spreads as well as the theory that suggests that the flexibility to reduce investment should increase credit spreads. However, the small magnitude of the coefficient suggests that the originators may be endogenously adjusting loan characteristics based on the NOI/Value ratio.

Another coefficient that agrees with theory but is economically insignificant and indicates endogenous choice is the coefficient of the amortization rate. While theory predicts that mortgages that amortize faster are less risky, and therefore command lower spreads, the empirical relationship indicates that a 20% increase in the amortization rate results in just a 1 b.p. decrease in spreads.

The results also reveal that newer properties have lower spreads. Specifically, compared to properties more than 30 years old, the credit spreads for mortgages on buildings that are

[8]A similar finding of endogenous choice of LTV was reported by Archer, Elmer, Harrison, and Ling (2002) where determinants of the probability of default were studied.

less than 5 years old are 12-13 b.p. lower. The spreads increase with the age of the property. This pattern is consistent with the observation that newer buildings have less flexibility, which reduces the spread.

Occupancy rates appear to have a positive relationship with spreads, but the magnitude of the effect is small. For example, an increase in the occupancy rate by 25% leads to an expected increase in the mortgage spread by only 1 basis point.

The coefficients of the dummy variables corresponding to the different property types indicate that multi-family apartment complexes have the smallest spreads, and full and limited service hotels and medical offices the largest. The difference between the spreads of these two types is approximately 80 basis points. These results are consistent with both volatility and investment flexibility being important determinants of credit spreads, since hotels are likely to be the property type with the most volatile cash flows as well as the type offering its owner the highest investment flexibility.

The coefficients for the variables corresponding to the dummy variables for the different ranges of mortgage maturity are both economically and statistically significant. In particular, the shortest term mortgages, with maturities less than 5 years, have the highest spreads while the longest term mortgages have the smallest spreads. On average the spreads of the mortgages with maturities shorter than 5 years are 39 b.p. above the mortgages with maturities longer than 10 years. This result is consistent with an endogenous choice of mortgage maturity, where riskier properties are given mortgages with shorter maturities and higher spreads.

The coefficient of the logarithm of property value is significant and negative, indicating that economies of scale lead to lower spreads for bigger properties. This finding is also consistent with the assumption that default risk or default costs are expected to be lower for larger borrowers. The magnitude of the effect is considerable; the expected difference in spreads between the largest property in the data, with a value of $725,000,000, and the smallest, with a value of $60,000, is approximately 170 basis points.

Regarding mortgage originators, our results indicate that mortgages provided by large investment banks have spreads 2-3 basis points lower than other mortgages. While the magnitude of this effect is relatively small, the result is consistent with the intuition that lenders with a higher volume of mortgages can charge slightly lower rates because they are either more efficient, or are able to attract better quality borrowers.[9]

In results we do not report, we have checked that our analysis holds for different subsamples of the data. These include samples with all types of CMBS, only multi-family apartment complexes, only office buildings, the larger sample of mortgages in Conduit CMBS deals without information on property age or occupancy rate, and the subsample with mortgages originated between 1992 and 2000. Our main results hold on all of the various subsamples.

C. Lenders' Characteristics and Spreads: the clientele effect

The results in the previous subsection indicate that the characteristics of mortgage contracts should be viewed as an endogenous choice. For example, the evidence is consistent with the idea that riskier properties require lower LTV ratios, which indicates that the coefficient of LTV in the regressions presented in Table II are biased downwards.

A standard way to address this endogeneity problem is to use an instrument for the endogenous LTV ratio. This requires that we observe variables that influence the LTV ratio, but which have no independent influence on spreads. None of the variables that we have considered up to this point satisfies this criterion.

In this subsection we consider a relatively novel approach that helps us determine the extent to which the LTV ratio affects mortgage spreads. In particular, we consider the possibility that different originators have different tastes for risks and tend to specialize in mortgages with either high or low spreads. The low spread originators require low LTV ratios on the more

[9]The t-statistic of the coefficient may be overstated due to the large number of mortgages issued by the individual investment banks relative to other originators.

risky properties, while the high spread originators are willing to offer relatively high LTV loans on risky properties. If such a clientele effect exists, then we should observe a strong cross-sectional relation between the average LTV on mortgages offered by a given originator, and the spreads on the mortgages they originate.[10]

To investigate the hypothesis that different lenders specialize in loans with different levels of risk, we consider six new explanatory variables that measure the risk preferences of the originators. Three variables include 1) the average LTV ratios across mortgages issued by each originator; 2) the average amortization rate of issued mortgages per originator; and, 3) the average maturity of the mortgages issued by each originator.[11] The other three explanatory variables correspond to 4) the difference between the individual mortgage LTV ratio and the average LTV ratio; 5) the difference between individual mortgage amortization rate and the average amortization rate; and, 6) the difference between the individual mortgage maturity and the average maturity, where averages are taken over all the mortgages issued by each originator. In this specification the average mortgage characteristic per originator serves as a proxy for the risk of the mortgage.[12] Effectively, by introducing variables for originator averages we decompose variables into two parts. For example: Mortgage LTV $=$ (Mortgage LTV $-$ Average LTV ratio per originator) $+$ Average LTV ratio per originator.

We examine the relationship between the originator averages and mortgage spreads in a cross-sectional regression similar to the one estimated in Section III.B. The results are presented in Table III. We observe that, consistent with the clientele hypothesis, the average LTV ratio of the originator is strongly positively related to spreads — originators that are willing to offer mortgages with high LTV ratios charge higher spreads. We note that the coefficient for

[10] Ambrose, Benjamin, and Chinloy (2003) document a very specific clientele effect in the mortgage market. They show that bank and non-bank lenders in commercial mortgages take a different lending approach in assigning mortgage terms. Banks use interest rates to adjust the credit conditions while non-banks rely on adjusting the loan terms.

[11] We eliminated mortgages whose originators are unknown, and mortgages whose originators issued fewer than 10 mortgages in our sample. Approximately 20,000 mortgages remained in our data set.

[12] The averages per originator are calculated based only on the information of mortgages in our sample. Since originators likely have more mortgages that are not in our sample, our averages may not necessarily represent the true average per originator. However, we think these variables do not introduce any bias.

the average LTV per originator is 1.7 which is almost 10 times greater than the coefficient of 0.182 for the LTV variable in the first specification of cross-sectional regression in Table II. The t-statistic for the variable of average LTV per originator also improves significantly compared to the t-statistic for the LTV variable. Moreover, the R-square increases from about 45% to 50% suggesting that the inclusion of variables for originator averages leads to an increase in explanatory power.

We also note that the coefficient for the variable of the difference between the individual mortgage LTV ratio and the average LTV ratio per originator has significantly lower explanatory power, indicating that the LTV ratio has much less ability to explain differences in spreads offered by the same originators. This is not surprising, and is consistent with the idea that originators tend to specialize in mortgages of a given level of risk, and require mortgage terms (e.g., LTV ratios) that offset the underlying risk of the properties.[13]

On the other hand, it appears that the clientele effect does not extend to the amortization rate or maturity of a mortgage preferences of originators.[14] These results are consistent with findings in Ambrose, Benjamin, and Chinloy (2003) who show that the LTV ratios are the most important parameter that non-bank lenders choose to adjust in the face of changing environment, while banks tend to adjust the mortgage rates. As a result, non-banks tend to make low LTV ratio loans to riskier properties.

D. Time Series Results

As we mentioned in Subsection III.B, our cross-sectional regressions include quarterly dummy variables that capture macro-economic fluctuations that can affect default spreads. In this

[13]The observed pattern also supports the theory that borrowing rates and spreads are "sticky" (see Berger and Udell (1992) and Allen, Rutherford, and Wiley (1999)). Indeed, we seldom observe spreads of newly originated mortgages wider than 4%; while we observe LTV ratios that range from above 95% to below 10%.

[14]We have also calculated the correlation between the average LTV ratio, amortization rate, and mortgage maturity per originator. The correlation between average LTV ratio and average amortization rate is -33%, the correlation between average LTV ratio and average maturity is -16%, and the correlation between average amortization rate and average maturity is 48%.

subsection we examine these fluctuations in more detail by regressing the coefficient estimates of the quarterly dummy variables from our cross-sectional regression on a variety of macro-economic variables. This two-stage procedure is necessary in order to correctly calculate the t-statistics for the coefficients of the macro-economic variables.

The macro-economic variables we examine include the level of interest rates, the spread between the rates on AAA and BBB-rated corporate bonds, the performance of real estate assets in the previous year, and the cumulative write offs of loans on commercial property and of all real estate loans in the previous year. These independent variables are regressed on the coefficients of the quarterly dummy variables estimated in the regressions described in Table II as shown below

$$\begin{aligned}\text{Spread Quarter Dummy} = {} & \text{C} + a \times \text{10 year Treasury rate} \\ & + b \times \text{Spread between AAA and BBB-rated Corporate Bonds} \\ & + c \times \text{NCREIF Return over the Previous Four Quarters} \\ & + d \times \text{One year Cumulative Write offs for Commercial Property Loans} \\ & + e \times \text{One year Cumulative Write offs for All Real Estate Loans} \\ & + \varepsilon \end{aligned} \tag{2}$$

The dependent variable in the above regression represents average deviation from the predicted default spread in a given quarter, and corresponds to the coefficient of the dummy quarter variable for the last regression specification in Table II. A higher interest rate, measured by the 10 year Treasury rate, should theoretically lead to a decrease in spreads (see Titman and Torous (1989)). The spread between the rates on AAA and BBB bonds can be viewed as either a proxy for the liquidity of the credit markets, or, alternatively, the risk of the overall economy. The NCREIF index return, as well as the cumulative write offs of commercial property loans, measure both the riskiness of the real estate market as well as the financial health of mortgage

originators. The cumulative write offs for all real estate loans measure the riskiness of the overall real estate market. Summary statistics for these variables are presented in Table IV.

The time series regression results, corrected for first-order autocorrelation of the residuals, are presented in Table V.[15] Our regression estimates indicate that these independent variables explain about 20% of the observed variation in credit spreads.

Table V reveals that an increase in Treasury rates results in a decrease in spreads. Specifically, the estimates suggest that a 100 basis point increase in Treasury rates results in about a 32-37 basis point decrease in spreads. This change in spreads is too large to be fully attributed to the theoretical effect described in Titman and Torous (1989) and Titman, Tompaidis, and Tsyplakov (2004), and probably also reflects a decline in LTV ratios that also corresponds to increases in Treasury rates.[16]

We also find that the relation between the AAA-BBB spread and mortgage spreads is negative and only marginally significant. This is somewhat surprising since commercial mortgages generally have spreads that are similar to BBB corporate spreads. This lack of correlation could be due to two offsetting factors. On one hand, commercial real estate is easier to value and has higher recovery rates in the event of financial distress than most corporate assets, making it a more attractive source of collateral in periods when the AAA-BBB spread is high and the economy is very uncertain. On the other hand, when uncertainty is high borrowers may only be able to obtain financing for the least risky properties.

In addition, this result is consistent with the literature that suggests that the real estate market and its credit markets are not fully integrated with corporate credit markets and the stock market. Lizieri and Satchell (1997), Wilson, Okunev, and Webb (1998), Glascock, Lu, and So (2000), Okunev, Wilson, and Zurbruegg (2000) show that, although credit markets for

[15] We used the Newey-West autocorrelation correction.

[16] For example, from the Titman, Tompaidis, and Tsyplakov (2004) paper, a 100 basis points increase in Treasury rates should result in an approximately 15 basis point decrease in credit spreads.

mortgages have become more integrated with other markets over recent decades, the link is both imperfect and non-stationary.[17]

In contrast to our results, Maris and Segal (2002) and Nothaft and Freund (1999) find a significantly positive relationship between CMBS spreads and the corporate AAA-BBB spread. However, the economic specification in those papers is different from ours. In their regressions that explain credit spreads, the level of Treasury rates is not included as an independent variable. Since the level of Treasury rates is highly negatively correlated with the AAA-BBB spread, the differences between their results and ours is easily explained.[18]

The coefficients of the remaining variables indicate that following poor financial performance of either the real estate market, or the credit market for real estate, spreads increase. This behavior is consistent with either increased risk in the real estate and credit markets or with a decrease in the supply of mortgage capital following periods of poor financial performance.

IV. The Determinants of Mortgage Characteristics

This section examines the cross-sectional and time-series determinants of mortgage characteristics. In particular, we examine LTV ratios, amortization rates and mortgage maturity.

[17] Also, Allen, Rutherford, and Wiley (1999) document that mortgage rates appear to be "sticky" in their adjustment to changes in capital-market rates. The "stickiness" is more pronounced when capital market rates are falling rather than when they are rising.

[18] The correlation between the 10-year Treasury and AAA-BBB corporate spread is approximately -60% for the 1992-2002 period.

A. Cross-sectional results

To understand the determinants of mortgage characteristics, we estimate the following regression:

$$\begin{aligned}\text{Dependent Variable} = \text{intercept} &+ \sum a_i(\text{property characteristics variables})_i \\ &+ \sum b_i(\text{property type dummy variables})_i \\ &+ c(\text{originator dummy variable}) \\ &+ \sum d_i(\text{quarterly time dummy variables})_i \\ &+ \varepsilon\end{aligned} \tag{3}$$

where the dependent variables are the LTV ratio, the amortization rate, and the maturity of the mortgages. The independent variables include all of the variables in regression Equation (1) except for the variables that describe loan characteristics.

The regression estimates, reported in Table VI, reveal that the NOI/Value ratio is the most important cross-sectional determinant of LTV ratios, with an increase of 5% in the NOI/Value ratio resulting in an increase of 3% in the LTV ratio. This relationship suggests that originators may require certain levels of debt service coverage ratios. The NOI/Value ratio is also a statistically significant determinant of mortgage amortization rates, with an increase of 5% in the NOI/Value ratio resulting in an 1% increase in the amortization rate. This relationship suggests that mortgages on properties with incomes that are likely to decrease tend to have mortgages that amortize faster.

Age is also a determinant of LTV ratios; properties that are less than 5 years old have, on average, LTV ratios that are 4.3% above the LTV ratios for properties that are over 30 years old. This might be because younger properties have more certain cash flows since it is less likely that they would need major unexpected repairs. Occupancy rates have a significantly positive relationship with LTV ratios and significantly negative relationship with amortization rates, while they do not appear to be a determinant of mortgage maturity. These results can be

due to the higher income of properties with higher occupancy rates, allowing for larger loans, and for loans that amortize slower.

Property type also affects mortgage characteristics, with multi-family apartment complexes and anchored retail properties having mortgages with higher LTV ratios and lower amortization rates. On the other hand, limited and full service hotels have mortgages with lower LTV ratios that amortize faster.[19] In addition, mortgages on limited service hotels have significantly longer maturities (between 0.5-1.2 years), compared to other types.

The value of the property is not a significant determinant of LTV ratios, but it is important for amortization rates and mortgage maturity. Specifically, the expected difference in amortization rates between the biggest property in the data, with a value of $725,000,000, and the smallest one, with a value of $60,000, is 19%; the expected difference in mortgage maturities is 0.9 years — on average bigger properties amortize slower and have longer maturities.

B. Time-series results

To capture the time-series variation in mortgage characteristics we run three time-series regressions on the coefficients of quarterly dummy variables that are calculated from the three cross-sectional regressions for LTV ratios, amortization rates and mortgage maturity, respec-

[19] From Table I, we note that the property types with the lowest LTV ratios also have the highest expense to revenue ratios.

tively, presented in the previous subsection. The specifications for three regressions are as follows:

$$\begin{aligned}\text{Quarter Dummy} = \text{C} &+ a \times \text{10 year Treasury rate} \\ &+ b \times \text{Spread between AAA and BBB-rated Corporate Bonds} \\ &+ c \times \text{NCREIF Return over the Previous Four Quarters} \\ &+ d \times \text{One year Cumulative Write offs for Commercial Property Loans} \\ &+ e \times \text{One year Cumulative Write offs for All Real Estate Loans} \\ &+ \varepsilon \end{aligned} \tag{4}$$

The dependent variables represent the average deviation from the predicted LTV ratio, amortization rate and mortgage maturity in a given quarter.

The time-series regression results, corrected for first-order autocorrelation of the residuals, are presented in Table VII. Our regression estimates indicate that these independent variables explain up to 80% of the observed variation in LTV ratios, 70% of the variation in amortization rates, and 50% of the variation in mortgage maturities.

Table VII reveals that an increase in interest rates results in a decrease in LTV ratios and an increase in mortgage maturities, but that interest rates are not significant determinants of amortization rates. In particular, a 100 basis point increase in Treasury rates results in an average 2-3% decrease in LTV ratios and an increase of mortgage maturities by 0.5-0.6 years. This finding provides an intuitive explanation for the magnitude of the sensitivity of mortgage spreads to changes in interest rates described earlier. Recall that, in Section III.B we argued that the observed narrowing of the credit spreads that occurs when interest rates increase is greater than one would expect to observe in theory. The results in this section suggest that part of that narrowing may be due to the fact that borrowers tend to reduce LTV ratios when

interest rates increase.[20] The decrease in LTV ratios can be attributed to interest coverage requirements which are more likely to be binding constraints when interest rates are high, or to the borrowers' preference for making larger down payments in periods of higher interest rates.

In addition, and similar to what we found for the time-series variation in spreads, LTV ratios decline and amortization rates increase following periods of poor performance for the real estate market. This result demonstrates that borrowing terms become stricter when real estate markets exhibit lower returns and default rates of existing real estate loans increase.

Coupled with the increase of spreads following periods of poor financial performance, this behavior provides further support for the theories that past periods of poor financial performance are associated with either increased risk for the real estate and credit markets, or, with less competition for the provision of financial capital.

Our results also indicate that the AAA-BBB spread does not influence significantly mortgage LTV ratios, or maturities, and is only significant for amortization rates, with a higher AAA-BBB spread resulting in lower amortization rates.

V. Summary and Conclusions

The theoretical relation between credit spreads on fixed income instruments and the characteristics of both the contracts and the collateral is now pretty well understood. However, in order to apply and improve existing models, it is important to have a better understanding of what determines these credit spreads empirically.

Our empirical analysis of commercial mortgages included in conduit CMBS deals provides evidence that is largely consistent with the theoretical predictions. In particular, property

[20] Even though we controlled for changes in LTV in the cross-sectional regressions for spreads in Section III.B, the results do not account for the endogenous choice in LTV ratios when interest rates increase.

characteristics that should in theory be associated with higher spreads, e.g. proxies for risk, payouts and flexibility, are in fact associated with higher spreads. However, we also uncover some challenges that should be examined further in future research. Specifically, the evidence relating to loan characteristics and spreads is difficult to interpret, possibly because these are endogenous choices that are likely to be related to the risk of the mortgaged properties. Our evidence indicates that riskier properties generally require higher down payments, higher amortization rates, and shorter mortgage maturities.

Our time-series evidence suggests that in addition to the characteristics of the mortgages and the properties, the financial health of the originators has an effect on mortgage spreads. We find that the past performance of real estate markets, which is likely to affect the ability of financial institutions to originate new loans, is a significant determinant of the time-series variation of default spreads and of mortgage collateral requirements. Our analysis of the time-series pattern of LTV ratios suggests that endogeneity issues may also affect observed fluctuations in credit spreads.

Our findings suggest a number of avenues for future research. In addition to further work on the above mentioned endogeneity issues it would be interesting to investigate whether the increase in spreads following poor financial performance is due to an increase in the level of risk for real estate investments, or whether the credit available for such investments shrinks after poor performance, leading to less competitive markets. While the relation between the financial health of financial institutions and credit spreads is outside the scope of existing fixed income pricing models it is an area that should be considered.

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Table I
Summary Statistics: Mortgage and Property

Average property characteristics and mortgage characteristics for different property types. The averages are listed by property type as well as over the entire sample. Property value is measured in millions of dollars. NOI/V is the net operating income to value ratio, Exp/Rev is the expense to revenue ratio, LTV is the loan to value ratio, Spread is the difference between the mortgage rate and the corresponding Treasury rate measured in basis points, Amort is the amortization rate measured as 1 - Balloon/Principal, Occ is the occupancy rate of the property at mortgage origination, Age is the age of the property at mortgage origination, Maturity is the maturity of the mortgage measured in years, and Perc is the percentage of mortgages for each property type.

Property Type	Value	NOI/V	Exp/Rev	LTV	Spread	Amort	Occ	Age	Maturity	Perc
Multi-family	6.1	9.4%	46.0%	71.3%	207	22.6%	96%	26.5	10.5	34.4%
Retail Unanchored	5.0	9.6%	26.8%	68.0%	229	24.6%	97%	16.2	10.7	12.6%
Retail Anchored	12.9	9.0%	26.9%	70.5%	216	19.8%	97%	13.9	10.5	14.2%
Medical Office	8.1	11.5%	74.5%	65.8%	256	26.8%	93%	19.1	10.5	1.5%
Industrial	7.0	9.4%	24.9%	67.4%	221	24.9%	98%	18.9	10.4	7.8%
Warehouse	7.5	9.2%	18.6%	64.8%	220	28.8%	98%	16.1	10.7	0.8%
Mobile Home	5.2	9.3%	44.3%	69.1%	219	20.0%	95%	27.3	10.1	3.3%
Office	12.8	9.1%	36.4%	67.0%	222	18.5%	96%	24.5	10.1	14.2%
Mixed Use	10.1	9.2%	35.5%	66.6%	235	20.7%	96%	37.4	10.4	2.3%
Limited Service Hotel	7.9	11.1%	64.4%	62.9%	262	39.9%	73%	14.2	12.2	4.4%
Full Service Hotel	22.5	10.0%	73.3%	59.9%	260	23.2%	72%	22.6	10.2	1.1%
Self Storage	5.0	10.2%	37.5%	64.9%	249	24.6%	90%	14.5	10.4	3.3%
All Types	8.3	9.5%	39.4%	68.8%	221	22.9%	95%	21.6	10.5	100%

Table II
Cross Sectional Regression: Spreads

Three cross-sectional regressions, with different specifications for the loan to value ratio (LTV). The dependent variable is the spread between the mortgage rate and the corresponding Treasury rate measured in percentage points. In addition to the variables reported in the table, the explanatory variables also include quarterly time dummy variables corresponding to the quarter of mortgage origination.

Number of Observations = 26114						
R-squared	44.8%		45.4%		45.2%	
Adjusted R-squared	44.7%		45.3%		45.1%	
Variable	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
C	2.667	60.8	2.374	21.8	2.483	50.9
Ln(Property Value, MM)	-0.179	-49.9	-0.176	-49.5	-0.177	-49.6
LTV	0.182	4.8			0.521	9.6
LTV ≤ 0.4			0.175	1.6		
$0.4 <$ LTV ≤ 0.5			0.350	3.4		
$0.5 <$ LTV ≤ 0.6			0.405	3.9		
$0.6 <$ LTV ≤ 0.7			0.453	4.4		
$0.7 <$ LTV ≤ 0.8			0.403	3.9		
$0.8 <$ LTV ≤ 0.9			0.376	3.6		
LTV above 70%					-0.100	-11.4
NOI/Value	0.677	5.2	0.707	5.5	0.677	5.2
Loan Amortization Rate	-0.045	-3.0	-0.038	-2.6	-0.046	-3.1
Occupancy Rate	0.034	2.5	0.040	2.9	0.038	2.8
Property Age Dummies						
Age ≤ 5 years	-0.128	-15.8	-0.124	-15.3	-0.127	-15.7
5 years $<$ Age ≤ 15 years	-0.100	-13.1	-0.100	-13.2	-0.100	-13.2
15 years $<$ Age ≤ 30 years	-0.057	-8.0	-0.057	-8.0	-0.058	-8.1
Mortgage Maturity Dummies						
maturity ≤ 5 years	0.391	11.0	0.402	11.4	0.397	11.2
5 years $<$ maturity ≤ 10 years	0.054	10.2	0.056	10.7	0.055	10.5
Property Type Dummies (vs. Mixed Type)						
Multi family	-0.386	-18.0	-0.370	-17.5	-0.377	-17.7
Retail Unanchored	-0.087	-4.0	-0.087	-4.0	-0.085	-3.9
Retail Anchored	-0.159	-7.5	-0.154	-7.3	-0.154	-7.2
Medical Office	0.123	3.7	0.131	4.0	0.129	3.9
Industrial	-0.185	-8.3	-0.186	-8.4	-0.182	-8.2
Warehouse	-0.198	-5.3	-0.202	-5.5	-0.197	-5.3
Mobile Home	-0.346	-14.2	-0.335	-13.9	-0.339	-14.0
Office	-0.106	-4.9	-0.110	-5.2	-0.105	-4.9
Limited Service Hotel	0.421	15.7	0.405	15.3	0.411	15.3
Full Service Hotel	0.458	13.3	0.447	13.0	0.450	13.1
Self Storage	0.015	0.6	0.007	0.3	0.010	0.4
Investment Bank Originator	-0.026	-3.6	-0.029	-4.1	-0.027	-3.8

Table III
Clientele Effects

This table presents a cross sectional regression for the spread between the mortgage rate and the corresponding Treasury rate. To account for clientele effects we use six explanatory variables: average LTV ratio per originator, average amortization rate per originator, average maturity per originator, and individual mortgage deviations from these averages. We have removed originators with fewer than 10 mortgages from the data, as well as mortgages with no information on originator.

Number of Observations = 20040		
R-squared	50.3%	
Adjusted R-squared	50.2%	
Variable	Coefficient	t-stat
C	1.84	16.8
Ln(Property Value, MM)	-0.17	-45.7
LTV minus average LTV per originator	0.07	1.9
Average LTV per originator	1.71	14.5
Maturity minus average maturity per originator	-0.01	-8.0
Average maturity per originator	-0.03	-4.1
Amortization minus average amortization per originator	0.02	1.1
Average amortization rate per originator	-0.08	-1.1
NOI/Value	0.79	5.2
Occupancy Rate	0.02	1.3
Property Age Dummies		
Age $\leq$ 5 years	-0.11	-12.8
5 years $<$ Age $\leq$ 15 years	-0.10	-11.7
15 years $<$ Age $\leq$ 30 years	-0.05	-6.9
Property Type Dummies (vs. Mixed Type)		
Multi family	-0.37	-18.5
Retail Unanchored	-0.08	-3.7
Retail Anchored	-0.15	-7.4
Medical Office	0.11	3.2
Industrial	-0.16	-7.5
Warehouse	-0.16	-4.4
Mobile Home	-0.32	-13.4
Office	-0.11	-5.3
Limited Service Hotel	0.39	14.3
Full Service	0.44	12.7
Self Storage	0.01	0.3
Investment Bank Originator	0.01	1.4

Table IV
Summary Statistics: Macroeconomic Variables

Summary statistics for the quarterly macro-economic variables for the period 1992-2002. The variables are the yield of the ten year Treasury bond, the spread between BBB and AAA corporate bonds, the write offs for commercial property loans cumulative over the previous year and expressed as a percentage of total value of all commercial property loans, the write offs for all real estate loans cumulative over the previous year and expressed as a percentage of the total value of all loans, and the NCREIF index return over the previous year.

Variable	Mean	Std. Deviation	Skewness	Kurtosis
Yield for 10Y treasury	5.99%	0.88%	-0.07	-0.33
Spread between BBB and AAA	0.78%	0.20%	1.67	2.33
1 Year Cum. Prior Write Offs for CP Loans	0.52%	0.73%	1.42	0.52
1 Year Cum. Prior Write Offs for All RE Loans	0.32%	0.36%	1.48	0.73
NCREIF return for the last 4 quarters	7.16%	6.20%	-0.84	0.03

Table V: **Time Series Regression: Macro-economic Effects on Spreads**

Four different regression specifications with the coefficients of the quarterly time dummy variables from Table II as the dependent variable. The independent variables are the quarterly values for the ten year Treasury rate, the spread between the BBB and AAA corporate bonds, the NCREIF index return over the previous year, the write offs for commercial property loans cumulative over the previous year, and the write offs for all real estate loans cumulative over the previous year. The regression results have been corrected for first-order autocorrelation.

Adjusted R-squared	19.0%		14.3%		18.0%		19.8%	
Variable	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
C	4.94	5.3	5.08	5.0	4.94	5.3	5.83	5.6
Yield for 10Y treasury	-0.34	-2.9	-0.32	-2.5	-0.34	-2.8	-0.37	-3.1
Spread between BBB and AAA	-0.80	-1.7	-0.87	-1.6	-0.87	-1.8	-1.03	-2.2
NCREIF return							-0.05	-3.3
Write Offs for CP Loans	0.42	2.9						
Write Offs for All RE Loans					0.83	2.7		

Table VI
Cross Sectional Regression: Mortgage Characteristics

Cross-sectional regression with dependent variable the mortgage loan to value ratio, amortization rate and maturity. In addition to the variables reported in the table, the independent variables also include quarterly time dummy variables corresponding to the quarter of mortgage origination.

	LTV		**Amortization**		**Maturity**	
Number of Observations = 26114						
R-squared	12.7%		15.7%		6.6%	
Adjusted R-squared	12.5%		15.5%		6.4%	
Variable	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
C	57.6%	71.8	25.0%	15.9	9.51	51.3
Ln(Property Value, MM)	-0.0007	-0.8	-0.020	-12.8	-0.097	-5.2
NOI/Value	0.622	16.2	0.197	2.6	2.59	3.0
Occupancy Rate	0.045	11.1	-0.031	-4.0	0.04	0.5
Property Age Dummies						
Age $\leq$ 5 years	4.3%	21.3	3.0%	6.5	0.94	15.8
5 years $<$ Age $\leq$ 15 years	2.6%	14.1	-2.9%	-7.3	-0.17	-3.5
15 years $<$ Age $\leq$ 30 years	1.5%	8.0	-0.7%	-2.0	-0.02	-0.5
Property Type Dummies (vs. Mixed Type)						
Multi family	6.2%	14.3	-4.7%	-4.8	-0.10	-0.9
Retail Unanchored	1.3%	2.9	-2.0%	-1.9	-0.11	-1.0
Retail Anchored	3.8%	8.4	-2.2%	-2.2	-0.03	-0.3
Medical Office	-1.2%	-1.5	-4.7%	-3.0	-0.47	-2.2
Industrial	0.9%	1.9	0.8%	0.8	-0.09	-0.8
Warehouse	-1.5%	-1.9	6.2%	2.9	0.25	1.2
Mobile Home	3.8%	6.7	-4.5%	-3.9	-0.44	-3.3
Office	0.7%	1.6	-2.9%	-2.9	-0.28	-2.5
Limited Service Hotel	-3.7%	-6.8	9.3%	6.9	0.70	4.2
Full Service Hotel	-5.3%	-6.3	0.6%	0.4	-0.19	-1.1
Self Storage	-1.9%	-3.5	-0.5%	-0.4	-0.23	-1.6
Investment Bank Originator	-0.9%	-4.6	0.5%	1.3	-0.05	-1.1

Table VII
Time Series Regression: Macro-economic Effects on Mortgage Characteristics

Four different regression specifications with the coefficients of the quarterly time dummy variables from Table VI as the dependent variable. The independent variables are the quarterly values for the ten year Treasury rate, the spread between the BBB and AAA corporate bonds, the NCREIF index return over the previous year, the write offs for commercial property loans cumulative over the previous year, and the write offs for all real estate loans cumulative over the previous year. The regression results have been corrected for first-order autocorrelation.

Panel A: Loan to Value Ratio

Adjusted R-squared	84.2%		65.1%		83.9%		82.3%	
Variable	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
C	0.650	11.3	0.763	10.6	0.650	11.2	0.559	7.8
Yield for 10Y treasury	-0.018	-2.6	-0.035	-4.1	-0.018	-2.6	-0.013	-1.6
Spread between BBB and AAA	-0.003	-0.1	-0.040	-1.1	0.003	0.1	0.023	0.7
NCREIF return							0.004	4.5
Write Offs for CP Loans	-0.032	-5.0						
Write Offs for All RE Loans					-0.065	-5.0		

Panel B: Amortization Rate

Adjusted R-squared	72.9%		16.5%		68.3%		70.4%	
Variable	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
C	0.560	2.1	1.193	2.6	0.574	2.0	1.383	4.2
Yield for 10Y treasury	-0.009	-0.3	-0.074	-1.3	-0.010	-0.3	-0.048	-1.3
Spread between BBB and AAA	-0.287	-2.2	-0.316	-1.3	-0.342	-2.4	-0.522	-3.6
NCREIF return							-0.036	-8.6
Write Offs for CP Loans	0.303	9.2						
Write Offs for All RE Loans					0.614	8.2		

Panel C: Maturity

Adjusted R-squared	50.9%		52.4%		50.9%		51.4%	
Variable	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
C	7.71	3.6	7.92	4.0	7.68	3.5	7.05	2.7
Yield for 10Y treasury	0.57	2.1	0.54	2.3	0.57	2.2	0.63	2.2
Spread between BBB and AAA	-0.73	-0.7	-0.80	-0.8	-0.71	-0.7	-0.53	-0.5
NCREIF return							0.02	0.5
Write Offs for CP Loans	-0.06	-0.2						
Write Offs for All RE Loans					-0.14	-0.3		