A Study on Credit Spreads in Japanese REIT Loans

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Abstract

Credit spreads of loans are expected to show credit risks on the loans as well as the market strength of the participants. This study examines credit spreads on Japanese REIT loans. The results show clear sensitivities against character of the loans such as credit ratings or loan to value ratio of the REIT. The sensitivities are quite consistent with qualitatively expected tendencies. The time series analysis reveals that the credit spreads move along strength of the economy, and the timings are earlier than market prices movement. That means that the credit spread works as a good leading indicator of the market trend.

Keywords: credit spread, commercial mortgage, Japanese REIT loan, time-series analysis.

1 Introduction

1.1 Overview

A credit spread is defined as the difference in yield between a financial security without any credit risk and the same security with credit risk. Another expression is that credit spreads are the additional cost in yield for borrowers against risk free rate. Credit spreads, therefore, are expected to reflect credit risks of the issuers through activities of lending. Credit spreads are analyzed for a long time in various studies. The determinants of the spreads are also studied in many case, such as Jones, et al. (1984)[6)] or Collin-Dufresne, et al. (2001)[1)].

Another aspect of credit spreads is that they indicate strengths or weakness of the participants in the market. If lenders, for example, have strong view on the market, credit spreads on the loans become low level. Or borrowers compromises high rate in sluggish economy. Therefore adequate time series analysis on the credit spread should reveal the market situation precisely and timely.

Analyses on commercial mortgages, on the other hand, are found in a few studies. Titman, et al. (2005)[5)] studied the determinants of credit spread in commercial

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mortgages. In their studies, the loan to value ratio (LtV) is one of the major determinants of the spread in commercial mortgage loan.

This study analyzes the determinants of the credit spreads of the Japanese REIT (J-REIT) market. Loans for REIT are different from the commercial mortgage. The largest difference between commercial mortgages and REIT loans is that commercial mortgages have one or several assets in their collaterals while REIT loans have all the portfolio of normally dozens of properties as collaterals. But the REITs have only properties, and cash in a small fraction, in their asset. Loans for REITs are treated as if they are commercial mortgage in this study.

Spreads are calculated from the executed loan rates at the issue and risk free rates. Analysis is executed by regressions of the spreads upon various independent variables. The result shows clear tendencies against various characters of the loans, and, most of all, credit rating. The result of the time series analysis indicates timely varying spread to the real estate market. The credit spreads are found to lead the transaction of commercial real estate market by comparing transaction cap rate.

The structure of this paper is as follows. The second section is the empirical analysis that explains data specification and analyzing model. The third section is the result and consideration of the result. The fourth section summarizes this study.

1.2 Previous Studies

The determinants of credit spreads have been analyzed in many studies. Collin-Dufresne, et al. (2001)[1)], for example, found that there exists a common factor that explains credit spreads rather than theoretical explanatory variables. They suggest the common factor is driven by local supply/demand shocks that are independent of credit-risk factors and major macroeconomic factors.

The analyses on the determinant of credit spreads in commercial mortgages, however, are limited. Titman, et al. (2004)[5)] suggest that the LtV ratio has relatively weak relation with credit risk, but the average LtV ratio per lender has strong relation with credit spreads. The study also suggests that spreads moves along market conditions as spreads widen after the period of poor performance. The next equation is the regression of credit spreads on property and mortgage characteristics.

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

The result shows that R-square is as high as 45% and the log of property value has the highest t-stat in the independent variables.

2 Empirical Analysis

2.1 Data

The data of spread is collected from the disclosure information of all the J-REITs. It includes issuers of REIT, exercised dates, terms of the loan, and rates of the loan. The spreads are calculated by subtracting base rates from the exercised rates. TIBORs[1] and swap rates on the date of exercise are selected as the base rates for the short and long term loans respectively. Additional information is collected separately. It includes the ratings of each J-REIT, LtV value of the J-REIT at the end of fiscal period, and existence of collateral.

The number of the data is 4,934 including loans information as well as bonds information. The date of the loans ranges from May 2001 to February 2014. As the data is used at maximum on different model, the sample numbers are different from each model.

2.2 Model

Four regression models are developed to analyze the spreads. Common variables and one additional variable are used as independent variables for each model.

Common variables

1. Time ($time$). The half of each year is used to identify the time of issue.
2. Term of loan ($term$). A flag is used to distinguish short or long term loan. Long term means the term is longer than one year.
3. Types of debt ($type$). Some of the REITs issues bonds, but the number of bonds is far less than the number of loans. A flag is used to distinguish loans from bond.
4. Existence of collateral ($collat$). Some of the loans are issued with the specific collateral. A flag is used to distinguish loans with or without collateral.

Four additional explanatory variables are used on the four different models.

Additional variables

1. Code ($code$). Code is a company code number to identify the REIT in the J-REIT market.
2. Rating ($rating$). Ratings are provided from a Japanese rating agency, *Rating and Investment Information, Inc.* The ratings range from AA- to BB.
3. LtV (ltv). LtV of the issuer at the end of fiscal year is converted into dummy variable. The ranges are $<$50%, $<$60%, $<$70%, $<$80%, $<$90%, and $\geq$90%.

[1] Tokyo Interbank Offered Rate. Lately most of the floating rate loans are based on TIBOR.

4. REIT Type($reit\ type$). Each REIT has an investment policy such as investing into offices only or residences only. The REIT Type flag partitions all the REIT into 7 groups, that are office specific, residence specific, logistics specific, hotel specific, retail specific, combination, and general.

Four regression models are used to analyze the spreads with different explanatory variables. The next equation is the general form of the regression model.

$$Spread_i = \sum_{k \in P_n} \sum_{j=1}^{N_k} a_j^k 1[p_i^k \in gr_j^k] + intercept + \epsilon_i, n = 1, 2, 3, 4 \qquad (2)$$

P_n is a group of categories for model 1 through 4 defined as follows.

$$\begin{aligned}
P_1 &= \{time, term, type, collat, code\} && \text{, model 1} \\
P_2 &= \{time, term, type, collat, rating\} && \text{, model 2} \\
P_3 &= \{time, term, type, collat, ltv\} && \text{, model 3} \\
P_4 &= \{time, term, type, collat, reit\ type\} && \text{, model 4}
\end{aligned}$$

N_k is the number of category k. a_j^k is a coefficient for the category k with group number j. $1[\ ]$ is a indicator function. p_i^k is a specification in category k of property i. gr_j^k is j-th group of category k. Therefore $p_i^k \in gr_j^k$ means that the specification of category k of property i belongs to the j-th group of category k.

To clarify the equation, plain form for model 1 is described in the next equation.

$$\begin{aligned}
Spread_i = &\sum_{j=1}^{N_{time}} a_j^{time} 1[time_i \in gr_j^{time}] + \sum_{j=1}^{N_{term}} a_j^{term} 1[term_i \in gr_j^{term}] \\
&+ \sum_{j=1}^{N_{type}} a_j^{type} 1[type_i \in gr_j^{type}] + \sum_{j=1}^{N_{collat}} a_j^{collat} 1[collat_i \in gr_j^{collat}] \\
&+ \sum_{j=1}^{N_{code}} a_j^{code} 1[type_i \in gr_j^{type}] + intercept + \epsilon_i \qquad (3)
\end{aligned}$$

For other models, the fifth term, $code$, in the right-hand side should be replaced by $rating$, ltv or $reit\ type$ respectively.

3 Result

3.1 Coefficients of Result

The results of the regression are shown in the Table 1. In the table, p-value is for a category instead of for a category score. The category score is a score for one explanatory variable in one category. We regards a category is more important

Table 1 Regression Results

Parameter	model 1	model 2	model 3	model 4
Std. Err.	0.281	0.199	0.335	0.339
R-square	0.606	0.645	0.429	0.417
Adj. R-square	0.596	0.640	0.424	0.411
AIC	1120	-953	2166	2372
BIC	1654	-731	2385	2624
N	3440	2547	3266	3440
category	p-value			
time	<0.001	<0.001	<0.001	<0.001
term	<0.001	<0.001	<0.001	<0.001
type	<0.001	<0.001	<0.001	<0.001
collat	<0.001	<0.001	<0.001	<0.001
code	<0.001			
rating		<0.001		
ltv			<0.001	
reit type				<0.001
intercept	0.149	0.003	0.001	0.197

than a category score to verify the effectiveness. Therefore p-values for category are listed in the table.

As the degree of freedom and the sample numbers are different from each other, BIC should be used to compare the effectiveness among the models. The results show that the model 2 has the highest R-square and the lowest BIC. This means the ratings can explain the spreads more than the code or LtV of the REIT.

The most important suggestion from the results is that coefficients from the regressions are quite consistent with the qualitative request. Figure 1 through 3 are the regression coefficients. The vertical axis in the figures is the spread expressed by coefficients of each parameter plus intercept.

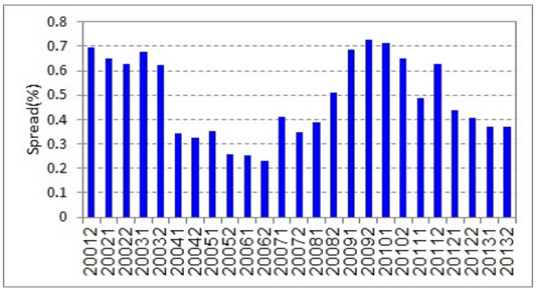

Figure 1 Coefficients of time

Figure 1 is the coefficients of $time$ plus the $intercept$ from the model 3. The horizontal axis indicates the time and the last digit expresses the half of the year, such as 20012 corresponds to the second half of the year 2001. Figure 1 shows the coefficients plus intercept from the model 3. You can see that the spreads moves along ups and downs of the economy. In and around 2006 spreads squeezed down to around 25 basis points, while in the middle of the financial crisis around 2009 spreads soars above 70 basis points.

Figure 2 is the coefficients of $rating$ plus the $intercept$ from the model 2. It is not flat slope, but upslope tendency against ratings is clearly shown. The tendency is quite consistent with qualitative expectation.

Figure 3 is the coefficients of ltv plus the $intercept$ from the model 3. It also shows the upslope against the LtV. The tendency is consistent with qualitative expectation as well.

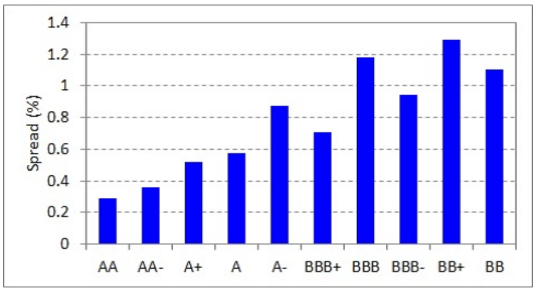

Figure 2 Coefficients of Rating from the Model 2

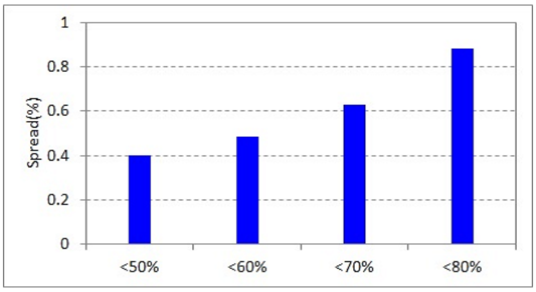

Figure 3 Coefficients of LtV from the Model 3

The table 2 shows the coefficients for common variables. It indicates that the short term loans have lower rates than the longer loans, and bonds have lower rates than loans. The last category, collateral, indicates that loans with specific collaterals have higher rate than that without collaterals. This looks contradictory because having specific collaterals with some properties in the REIT should lower the credit risk. The results, however, can be regarded as the loans with collaterals have higher risk than loans without collaterals and the collaterals are not enough to fill the additional cost by the credit risk. That is why loans with collaterals have higher rate.

Table 2 Coefficients of Common Variables

category	variables	model 1	model 2	model 3	model 4
$term$	short	-0.10	-0.11	-0.12	-0.11
	long	0.15	0.17	0.17	0.16
$type$	loan	0.01	0.01	0.01	0.01
	bond	-0.15	-0.10	-0.14	-0.13
$collateral$	without collat.	-0.02	-0.01	-0.09	-0.09
	with collat.	0.08	0.05	0.35	0.34

Coefficients for common variable are stable among four models except the coefficient with collateral in model 3. This means that existence of collateral has correlation with LtV, the specific variable for the model 3, and introduced unstable coefficients in the model 3.

3.2 Time Series Analysis

Figure 1 shows the market strength in time horizon, but information on time is summed up in the half of the year. As the spread data has the specific exercised date, more detailed time variance can be analyzed from the data. So new procedure is devised to calculate detailed time series as follows.

3.2.1 Rating Estimation

The model 2 is preferable with the high R-square in the models. But the sample size in model 2 is less than the original data. That is because all the REITs in the sample do not have a rating. Therefore the sample size should be enlarged for more robust analysis with rating as explanatory variables. In that purpose, the rating estimation is introduced using the result from the model 1 and 2. The coefficient from model 1 gives the spread for each J-REIT. And ratings can be estimated from the spread using the result of the model 2 as the simple linear regression.

$$rating_j = a\ spread_j + b + \epsilon_j \tag{4}$$

$spread_j$ is the coefficient from the model 2 for each rating ($rating_j$). Using the spread from model 1 ($spread_j^{M1}$), we can have the estimated rating ($rating^{est}$) as follows.

$$rating_j^{est} = a\ spread_j^{M1} + b \tag{5}$$

3.2.2 Model 5 with the Estimated Rating

We have now the estimated rating for all the REIT. The estimated ratings are applied to the REITs that do not have rating.

$$est\ rating_j = \begin{cases} rating_j \\ rating_j^{est} \text{ (no rating data)} \end{cases} \quad , j \in \text{J-REIT} \tag{6}$$

The estimated ratings are employed to run the regression model 5 as in (7).

$$\begin{aligned} Spread_i = &\sum_{j=1}^{N_{time}} a_j^{time} 1[time_i \in gr_j^{time}] + \sum_{j=1}^{N_{term}} a_j^{term} 1[term_i \in gr_j^{term}] \\ &+ \sum_{j=1}^{N_{type}} a_j^{type} 1[type_i \in gr_j^{type}] + \sum_{j=1}^{N_{collat}} a_j^{collat} 1[collat_i \in gr_j^{collat}] \\ &+ \sum_{j=1}^{N_{code}} a_j^{est\ rating} 1[est\ rating_i \in gr_j^{est\ rating}] + intercept + \epsilon_i \end{aligned} \tag{7}$$

The result of model 5 is in the table (3).

Table 3 Regression Results of Model 5

Parameter	value
Std. Err.	0.290
R-square	0.573
Adj. R-square	0.569
AIC	1300
BIC	1570
N	3440

category	p-value
$time$	<0.001
$term$	<0.001
$type$	<0.001
$collat$	<0.001
$est\ rating$	<0.001
$intercept$	0.252

3.2.3 Time Series Calculation Procedure

1. Using the coefficients of model 5, the time effect plus error term are defines as standard spreads. This standard spreads are adjusted into one condition in $type = loan$, $collateral = without\ collateral$, and $rating = A$. The separate models are used to calculate standard spreads for short and long term because short and long term spreads are expected to move independently.

$$Spread_i^{std,k} = \sum_{j=1}^{N_{time}} a_j^{time} 1[time_i \in gr_j^{time}] + c^{std,k} + \epsilon_i, \tag{8}$$

$$term_i \in gr_k^{term}, k = \{short, long\}$$

$$c^{std,k} = a_k^{term} + a_{loan}^{type} + a_A^{rating} + intercept \tag{9}$$

$c^{std,short}$ and $c^{std,long}$ work as adjusting constant terms for short and long term loans respectively. These constants convert all the data into the same condition of standard spreads.

2. The averages for each month for short/long term are calculated.

$$Avg_t^{std,k} = E[Spread_i^{std,k}|t_i = t], t : monthly, k = \{short, long\} \quad (10)$$

t_i is the date of loan exercise and t is monthly basis.

3. Kalman Filter function ($Kalman\_Filter$) is applied to make the curves smooth on these averages, $Avg^{std,k}$.

$$Filter_t^{std,k} = Kalman\_Filter(Avg_t^{std,k}), k = \{short, long\} \quad (11)$$

The result from the above procedure is shown in Figure 4 and 5 for short and long term loans respectively. The dots in the figures are the $Spread_i^{std,short/long}$ and the bold lines are the filtered lines, $Filter_t^{std,short/long}$.

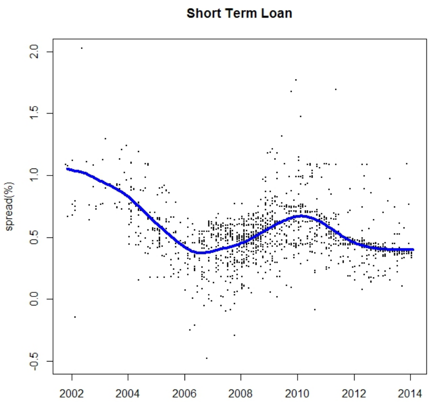

Figure 4 Spread of short term loan

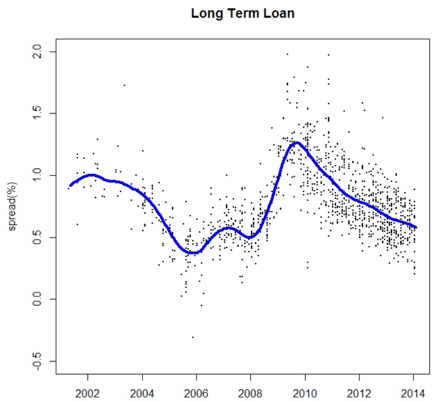

Figure 5 Spread of long term loan

3.3 Cap Rate

In the Figure 4 and 5, the movement of the spreads are clearly shown. And the timing of the movement is of interest for investors or lenders. Therefore the timings are compared with the market peaks and bottoms.

There are several ways to measure the market peaks and bottoms. But one of the concise way to measure the market movement is to trace transaction cap rates. Kanzaki (2012)[2)] finds out the procedure to calculate transaction cap rates. The procedure contains the equations such as (12) and (13) to grasp the tendencies.

The results show realistic sensitivity to various parameters, such as place, building size, or building age of the properties. And most of all, the cap rates shows quite spontaneous movement to the market sentiment.

$$r_t = \frac{NCF_t}{Price_t} \tag{12}$$

$$r_t = f(time, place, floor\ area, age, distance\ from\ station, \cdots) \tag{13}$$

In the equation (12), NCF is net cash flow, and $Price$ is transaction price. The function in the equation (13) is a linear regression function. The coefficient of $time$ in (13) can describe the movement of cap rate in time horizon.

Kanzaki (2013)[3)] finds out that the cap rate is the major parameter out of two parameters, cash flow and cap rate. About 85% of the price movement of commercial real estate attributes to the cap rate.

These findings leads to that we can use transaction cap rate as market proxy in its direction and timing. Figure 6 is the graph of the filtered spreads for short and long term with observed transaction cap rate[2].

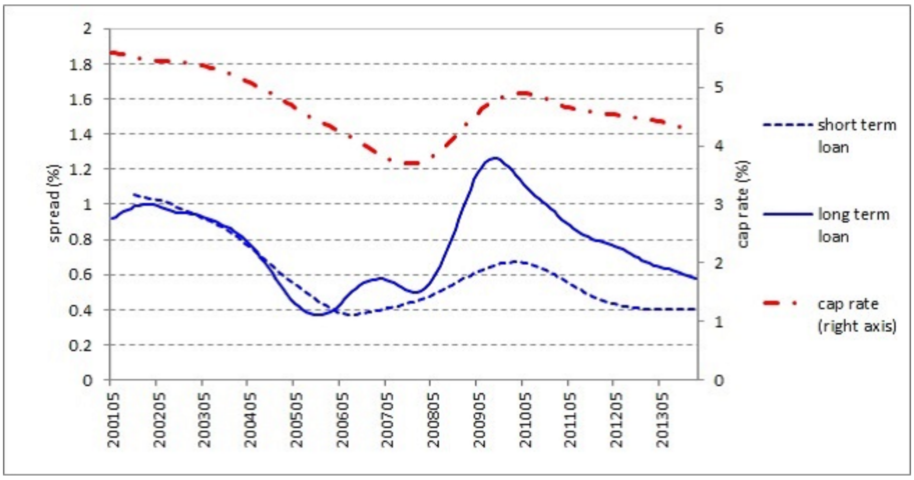

Figure 6 Spreads and cap rate

The spreads and the cap rate move through time horizon along economic strength. The peaks and bottoms appeared only a few cases due to long cycle of real estate market. But the bottoms of the spreads and the cap rate are direct responses to the strong economy, and the peaks are vice versa. Therefore we can compare the timings of the spreads and the cap rate.

Table 4 shows timings of the peaks and bottoms for the spread for short and long term loan and the cap rate. The numbers in the parentheses below the year

[2]The property for the cap rate is standardized to a building at Uchisaiwaicho, Chiyodaku, Tokyo of 5 years old with 10,000m^2

and month are the months of advancement against the cap rate. The results suggest that the spreads advances against the market movement. The advancements are larger in the bottom than in the peak with 15 and 23 months. This means that the spreads can be a good leading index of commercial real estate market, especially in the phase of collapse of the market.

Table 4 Peak/Bottom and its Advancement

peak/bottom	short term loan	long term loan	cap rate
bottom	2006/8 (15 month)	2005/12 (23 month)	2007/11
peak	2010/3 (1 month)	2009/9 (7 month)	2010/4

The numbers in the parentheses are advancement against the cap rate.

4 Summary

This paper examines the credit spreads of commercial mortgage from J-REIT data. The determinants of the spreads are well defined with R-square around 60%. That is higher result than the study of Titman, et al. (2005)[5)] with R-square around 45%. The results show suitable sensitivities to parameters, such as rating and LtV.

Time series analysis suggests that the spreads move along strength of the economy. And the timing of the movement is advanced against the price movement of the market. This suggests that the spreads of the loans are useful leading indicators of market movement. Therefore market participants should watch credit spreads carefully to monitor the market directions.

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