GPIF Working Papers

Real estate fund returns and debt ratio (leverage)

June 21, 2024
Amane Saito
Koichi Miyazaki

EXECUTIVE SUMMARY

- When a real estate fund acquires real estate, it is financed by debt portion (e.g., by bank loans) and equity portion (e.g., invested from investors). Normally, when institutional investors invest in a real estate fund, they are investing in the equity portion. If there are two real estate funds that acquire the same property but have different capital structures, institutional investors may earn different returns depending on which real estate fund they invest in.
- This study takes the debt ratio (leverage) as an indicator of capital structure and examines the impact of capital structure on the returns of real estate funds. This will allow institutional investors to build models to monitor the extent to which real estate funds are operating with an optimal debt ratio. In addition, it will pave the way for a relative value analysis of investments in real estate funds as alternative assets versus investments in corporate bonds as traditional assets.

(Note: This working paper is a compilation of research results by GPIF staff, and the contents and opinions expressed in the text do not represent the official views of the GPIF.

1. Introduction

When a real estate fund acquires real estate, it is financed by debt portion (e.g., by bank loans) and equity portion (e.g., invested from investors). Normally, when institutional investors invest in a real estate fund, they are investing in the equity portion (see Figure 1 in Section 2). Therefore, if there are two real estate funds with different capital structures that acquire the same real estate, the returns earned by institutional investors may differ depending on which real estate fund they invest in, even if they are investing in the same real estate.

This study takes the debt ratio (leverage) as an indicator of capital structure to examine the impact of capital structure on real estate fund returns. The positive impact of an increase in the debt ratio (leverage) (i.e., a reduction in the equity portion) on the return of a real estate fund is that it increases the return of the fund by allocating more of the rents earned from real estate to the smaller equity portion. Conversely, the negative impact of an increase in the debt ratio (leverage) (i.e., a reduction in the equity portion) is that, in addition to an increase in interest expense due to an increase in the amount of debt, the increase in the debt ratio increases credit risk, and the interest rate on the debt itself also increases.

I would like to contrast the impact of such a capital structure on the returns of real estate funds with the argument that ″if the strict assumptions of the MM theory (Miller and Modigliani (1961)), which assume a perfect capital market, are relaxed to bring it closer to reality, the discussion of the optimal capital structure

will be a trade-off between increased tax savings due to an increased debt ratio (leverage) and increased bankruptcy risk (increased interest expense). First, the disadvantage of increasing the debt ratio (leverage) is the same for both MM theory and real estate funds (increased bankruptcy risk (increased interest payments)). On the other hand, the advantages of an increase in the debt ratio (leverage) differ between MM theory and real estate funds: MM theory offers tax savings, while investments in real estate funds offer almost no tax savings due to an increase in the debt ratio (leverage). For example, assuming a J-REIT, a special exception under the tax law (Article 67-15 of the Act on Special Measures Concerning Taxation) is applied, which virtually exempts investment corporations of real estate investment trusts from corporate taxation. Under this special exception, if an investment corporation that meets certain conditions pays out an amount equivalent to more than 90% of its income before income taxes (income under the tax law) as distributions to unitholders, the amount equivalent to such distributions can be recorded as "expenses" under the Corporate Tax Law. In other words, real estate funds are virtually exempt from corporate tax in the first place, and the benefit of tax reduction does not depend on the debt ratio (leverage). In light of the above contrast, we can utilize prior research on optimal capital structure based on MM theory by adjusting the analytical framework so that the benefit of increasing the debt ratio (leverage) can be treated as an improvement in return rather than a tax saving effect. There are two frameworks for such prior research: the financial engineering approach and the corporate finance approach.

Brennan and Schwartz (1978), Leland (1994), and Leland and Toft (1996) are among the major previous studies of the financial engineering approach. Brennan and Schwartz (1978) was the first paper to attempt a quantitative analysis of optimal debt ratios. There, they determined the optimal debt ratio based on numerical analysis techniques, assuming that the debt-free firm value process follows a diffusion process of constant volatility. Although an important first step, the study does not provide analytical solutions for the value of risky debt or the optimal debt ratio, and thus does not provide a general comparative statics argument either. To overcome this, Leland (1994) examined the value of corporate debt and optimal capital structure in a unified analytical framework. Assuming that the value of corporate assets follows a diffusion process of constant volatility, they derived analytical results on the relationship between the value of long-term corporate debt and optimal capital structure with respect to parameters such as corporate risk, taxes, bankruptcy costs, etc. Leland and Toft (1996) extended the model of Leland (1994) to deal not only with the amount of debt (debt ratio) but also with the maturity structure of debt, and obtained analytical results that allow discussion of optimality in terms of both the debt ratio and the maturity structure. Thus, the financial engineering approach is superior in capturing the mechanism of the effect of parameters representing corporate characteristics on the value of corporate debt under the optimal capital structure through comparative statics. On the other hand, since credit spreads are determined endogenously, it is not flexible enough to set the real credit spreads observed from the corporate bond market, which is a hurdle for its use in practice.

The corporate finance approach is an approach that examines the optimal capital structure based on the so-called corporate valuation model. The corporate valuation model is explained in detail in Damodaran (2001), and Kokubo and Miyazaki (2005) extend this model to include not only the amount of debt (debt ratio) but also the maturity structure of debt. The corporate valuation model regards the discounted present value of future free cash flows generated by a company based on its weighted average cost of capital (WACC) as

its current corporate value. Since corporate value increases as the WACC decreases, the optimal capital structure is the debt ratio that minimizes the WACC, given the cost of equity and the cost of debt as priced in the financial markets. Both Damodaran (2001) and Kokubo and Miyazaki (2005) use a rating matrix (which represents credit spreads according to credit ratings) to describe the cost of debt priced in financial markets. Tsuchiya (2017) is another reference that gives some indication of the use of such an approach in practice. To quote the main points of Tsuchiya (2017), "(1) Given the fact that, in reality, the amount of debt funding and interest costs depend on ratings, how rating strategies are considered in the optimal capital structure approach is of paramount importance. (2) Ratings are often thought to be determined by the level of capital adequacy ratios and D/E ratios, but what is considered important in assigning a rating varies depending on the characteristics of the industry to which the company in question belongs. (3) The methodologies of the ratings are not disclosed in detail. Therefore, we would also like to add that in order to clarify the methodology, it is necessary to analyze the rating based on the status of other companies in the same industry that have obtained the rating."

Therefore, in this study, in a framework corresponding to citation (1), we take corporate bond yields as a substitute for the debt interest rates of real estate funds and examine the debt interest rates according to credit ratings. With regard to citations (2) and (3), we first refer to Niimi (1998) to confirm the relationship between credit ratings and financial indicators. Next, based on the ordered logit/probit model (Kobayashi (2001) and Kitamura (2009)), in which financial indicators including debt ratios are explanatory variables and the level of the quantified rating is the explained variable, we discuss the impact of debt ratios on the latent variables that determine the level of ratings. Linking these two analyses together, we finally discuss the impact of debt ratios on debt interest rates and returns of real estate fund. This will allow institutional investors to build models to monitor the extent to which real estate funds are operating with an optimal debt ratio. In addition, it will pave the way for a relative value analysis of investments in real estate funds as alternative assets versus investments in corporate bonds as traditional assets.

This paper is organized as follows. In section 2, we describe the scope and framework of the analysis and the rating data. In section 3, the relationship between ratings and financial indicators is clarified using an ordered logit/probit model. In section 4, we review the impact of debt ratios on debt interest rates and returns of real estate fund through numerical examples based on historical data. The final section will be accompanied by a summary and future issues.

2. Scope, framework and rating data

2.1 Scope and Framework of Analysis

This study will focus on the returns of institutional investors that invest in real estate funds. Figure 1 shows an image of the balance sheet of a real estate fund. As pointed out in section 1, when the ratio of debt increases (decreases) in fundraising by a real estate fund, the investment from investors (equity portion) decreases (increases) accordingly. Such changes in the debt ratio affect the investment returns of institutional investors through the proportion of the returns earned by the real estate fund allocated to the debt and equity portions. The impact of the debt ratio on institutional investors' returns ($return_t$) can be

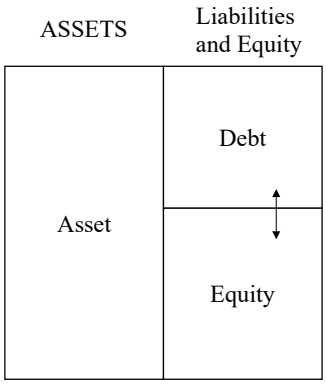
expressed by equations (1) to (3).

$$return_t = net\_realestate\_return_t/(1 - debt_t) \quad (1)$$

$$net\_realestate\_return_t = realestate\_return_t - debt\_cost_t \quad (2)$$

$$debt\_cost_t = r_t \times debt_t \quad (3)$$

The return on investment ($return_t$) is calculated as the net return on real estate investment ($net\_realestate\_return_t$) divided by the investment ratio ($1 - debt_t$). $net\_realestate\_return_t$ is calculated as the return on real estate investment ($realestate\_return_t$) less the cost of debt ($debt\_cost_t$). In this study, only the income return, which is the rental income from real estate at the present time t, is considered as the return of the real estate fund ($realestate\_return_t$), and factors such as the growth of rental income and the capital gain on the property it generates are not considered. As the debt ratio of the real estate fund increases (decreases), $net\_realestate\_return_t$ will decrease (increase) and $1 - debt_t$ will decrease (increase). Even if the same $realestate\_return_t$ is obtained, we can confirm the relationship that $return_t$ depends on the debt ratio. The debt interest rate (r_t) may rise or fall depending on the creditworthiness of the borrowing entity. This study focuses on the fact that r_t varies with the debt ratio.



(Source: Prepared by the authors)

Figure 1: Real Estate Fund Balance Sheet Image

Debt interest rate	Estimation ←	Explained variable: S&P / Fitch	Explained variable: Moody's	Ordered Logit/Probit Model ←	Explanatory variables: Indicator	Explanatory variables: Variable
		AAA	Aaa		Size	Total capital
	Investment grade	AA	Aa		Stability	Ratio of equity and capital reserves to total capital
		A	A		Debt ratio	Ratio of total liabilities to total equity
		BBB	Baa		Financial resilience	Ratio of EBIT to interest payment
	High Yield	BB	Ba		Profitability	Ratio of after-tax operating income to net sales
		B	B		Efficiency	Capital turnover
					Growth	Five-year average growth rate of net sales

(Source: Prepared by the authors)

Figure 2: Analytical Framework

Figure 2 illustrates the framework of the analysis. Based on Niimi (1998), seven financial indicators are used to explain ratings. Namely, the firm's (1) size, (2) stability, (3) debt ratio, (4) financial resilience, (5) profitability, (6) efficiency, and (7) growth indicators, each of which is used in an ordered logit/probit model with the rating as the explained variable. The rating is an ordinal number indicating the creditworthiness of the company. In the ordered logit/probit model analysis, the latent variable, which is the cardinal number corresponding to the explained variable, is calculated, and the coefficients of the explanatory variables are estimated. Next, the level of the credit spread is matched to each notch of the rating. This makes it possible to consider the amount of change in the level of the credit spread through the rating when the value of the explanatory variable changes, reflecting the coefficient of that variable. Specifically, the change in the latent variable is calculated when the debt ratio changes, and the level of the credit spread rises or falls accordingly, allowing the calculation of the change in the credit spread corresponding to the change in the latent variable, even if the change in the debt ratio does not result in a change in rating. In this study, investment returns are analyzed using the cost of debt with the credit spread calculated by this method.

2.2 Rating Data

The analysis covers companies in the S&P 500, as of August 31, 2023. We use Moody's ratings data for companies that are rated by at least two of the major rating agencies. We review the ratings of the sample, which are represented by notches (rating tiers) from Aaa to C in Moody's ratings. Each notch is assigned a number from 1 to 3, with 1 indicating a relatively high rank within the notch, 2 indicating a medium rank, and 3 indicating a relatively low rank. In this analysis, 16 notches from Aaa to B3 are included.

Table 1 shows the distribution of ratings for the 157 companies included in this analysis. No firms are

Table 1 Distribution of Ratings for Analysis

	Number of companies
Aaa	3
Aa1	0
Aa2	4
Aa3	7
A1	13
A2	17
A3	18
Baa1	25
Baa2	40
Baa3	9
Ba1	5
Ba2	6
Ba3	3
B1	4
B2	3
B3	0
合計	157

(Source: Authors' compilation from FactSet)

Table 2 Distribution of ratings for analysis (after aggregation)

	Number of companies
Aaa	3
Aa	11
A	48
Baa1	25
Baa2	40
Baa3	9
Ba	14
B	7
合計	157

(Source: Authors' compilation from FactSet)

assigned a rating of Aa1, and the same is true for rating of B3. Most of the companies assigned a rating are distributed between Baa1 and Baa3, while the number of companies assigned a rating from Aa2 to Aa3 (high rating) or from Ba1 to B2 (low rating) is relatively small. It is possible that the parameters of the ordered logit/probit model cannot be estimated due to this small number of companies in some notches. Therefore, in this analysis, we aggregate all notches other than Baa1 through Baa3 into a single notch by eliminating the distinction based on relative ratings within a notch. Table 2 shows the distribution of ratings after aggregation. Aggregation ensures enough samples above A and below Ba ratings.

3. Relationship between ratings and financial indicators

3.1 Model

In this section, based on Kitamura (2009), we provide a brief explanation of the ordered logit/probit model used in the empirical analysis that follows in the next section. The explained variables in the ordered logit/probit model are represented by the following ordinal numbers.

$$y_i = 1, 2, 3, \dots, J \ \ (1 < 2 < 3 < \cdots < J)$$

When such explained variables are estimated by the ordinary least squares, a problem arises because the explained variable is treated as a cardinal number. Therefore, in the ordered logit/probit model, we consider a regression model for the continuous latent variable corresponding to the explained variable (y_i^*). x_i' represents the explanatory variables (seven financial indicators). β is the parameter for each explanatory variable, and u_i is the error term. x_i' and β are vectors.

$$y_i^* = x_i'\beta + u_i \quad i = 1, 2, \dots, n$$

The observed data, the explained variable (y_i) and the latent variable are defined as followings. The real number is divided into J intervals, corresponding to J choices.

$$y_i = j \iff k_{j-1} < y_i^* < k_j \quad j = 1, 2, \dots, J$$

$$y_1 = 1 \iff k_0 < y_i^* < k_1 \iff k_0 - x_i'\beta < u_i < k_1 - x_i'\beta$$
$$y_2 = 2 \iff k_1 < y_i^* < k_2 \iff k_1 - x_i'\beta < u_i < k_2 - x_i'\beta$$
$$\dots$$
$$y_i = J \iff k_{J-1} < y_i^* < k_J \iff k_{J-1} - x_i'\beta < u_i < k_J - x_i'\beta$$
$$k_0 = -\infty, k_J = \infty$$

Considering the cumulative density function $f(u_i|x_i) = dF(u_i|x_i)/du$ of the density function $f(u_i|x_i)$ of

the error term u_i, we denote the case where y_i takes a certain value as follows.

$$\pi_{ij} = P(y_i = j|x_i) = F(k_j - x_i'\beta) - F(k_{j-1} - x_i'\beta)$$

If Gaussian distribution is used as the probability distribution function, the model is an ordered probit model, and if the logistic distribution is used, the model is an ordered logit model. The ordered logit/probit probability function multiplied by the above probabilities is as follows.

$$f(y_i|x_i;\beta,k_1,k_2,\dots,k_{J-1}) = (\pi_{i1})^{d_{i1}}(\pi_{i2})^{d_{i2}}\dots(\pi_{iJ})^{d_{iJ}} = \prod_{j=1}^{J}(\pi_{ij})^{d_{ij}}$$

$$d_{ij}\begin{cases}1 & \text{If } j \text{ is chosen}(y_i = j)\\ 0 & \text{otherwise}\end{cases}$$

The log-likelihood function is defined as follows and is estimated using the maximum likelihood method to obtain an unbiased estimator of the parameters.

$$\log L(\beta,k_1,k_2,\dots,k_{J-1};y,x) = \sum_{i=1}^{n}\sum_{j=1}^{J} d_{ij}\log\pi_{ij}$$

3.2 Relationship between ratings and financial indicators

Table 3 shows the distribution of ratings, the explained variable, and summary statistics for the explanatory variables. The rating distribution shows a concentration of companies in the A to Baa3 ratings. In terms of the explanatory variables, the debt ratio, ratio of total liabilities to total equity, which is the focus of this analysis, averages 67.99% for the sample companies, with a minimum value of 2.02% and a maximum value of 251.83%. Cases where the debt ratio exceeds 100% indicate that the company is insolvent. Next, the size indicator, total capital, averages $0.05 trillion for the sample companies, with a minimum value of $0.00 trillion and a maximum value of $0.37 trillion. The stability indicator, ratio of equity and capital reserves to total capital, averages 26.87%, with a minimum of 0.00% and a maximum of 729.46%. The average ratio of EBIT to interest payment for the financial resilience indicator is 20.03%, with a minimum of −15.62% and a maximum of 209.64%. The minimum value is negative, indicating that the company has a loss before interest and taxes. The profitability indicator, ratio of the after-tax operating income to net sales, averaged 15.11%; the efficiency indicator, the capital turnover, averaged 0.84%; and the growth indicator, the five-year average growth rate of net sales, averaged 8.32%.

Table 4 shows the estimation results of the ordered logit/probit model. The size, debt ratio, and profitability indicators are each significant. Thus, we confirm that firms with larger size, lower debt ratios, and higher

Table 3 Summary statistics

	Number of companies
Aaa	3
Aa	11
A	48
Baa1	25
Baa2	40
Baa3	9
Ba	14
B	7
合計	157

	Size	Stability	Debt ratio	Financial resilience	Profitability	Efficiency	Growth
	Total capital	Ratio of equity and capital reserves to total capital	Ratio of total liabilities to total equity	Ratio of EBIT to interest payment	Ratio of after-tax operating income to net sales	Capital turnover	Five-year average growth rate of net sales
Number of samples	157	157	157	157	157	157	157
Mean	0.05	26.87	67.99	20.03	15.11	0.84	8.32
Variance	0.07	59.42	28.35	29.88	11.80	0.89	8.38
Min	0.00	0.00	2.02	-15.62	-38.98	0.04	-8.92
25%	0.01	7.91	51.53	6.08	8.08	0.44	3.54
Median	0.03	17.99	64.30	9.99	14.14	0.65	7.09
75%	0.05	32.18	77.33	21.49	22.11	0.96	10.95
Max	0.37	729.46	251.83	209.64	52.75	8.89	48.85

(Source: Authors' compilation from FactSet)

Table 4 Estimation results

	Moody's (n=157)			
	Logit		Probit	
	Coefficient	SD	Coefficient	SD
Total capital	15.95 **	3.46	8.85 **	1.78
Ratio of equity and capital reserves to total capital	0.00	0.00	0.00	0.00
Ratio of total liabilities to total equity	-0.02 **	0.01	-0.01 **	0.00
Ratio of EBIT to interest payment	0.01	0.01	0.01	0.00
Ratio of after-tax operating income to net sales	0.07 **	0.02	0.04 **	0.01
Capital turnover	0.47	0.29	0.18	0.10
Five-year average growth rate of net sales	-0.03	0.02	-0.02	0.01

**p<0.01, *p<0.05

(Source: Prepared by the authors)

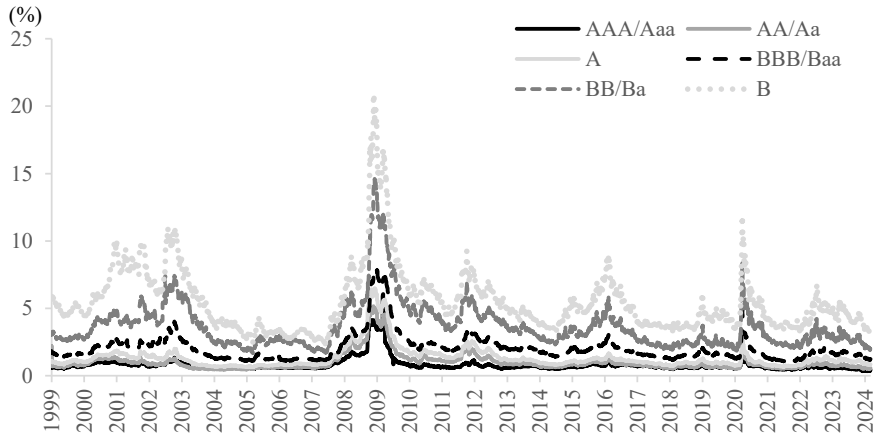
corporate profitability tend to have higher ratings. Therefore, a lower debt ratio, which is the explanatory variable focused on in this analysis, is likely to increase the latent variable of the rating and lead to a higher rating, suggesting that the debt interest rate is suppressed. In the next section, we will estimate the impact of debt ratio on the debt interest rate using the values of the coefficients of the logit model obtained in the estimation. The results of the estimation will also be used to discuss the optimal debt ratio for real estate investment.

4. Numerical example

4.1 Data and Analysis Setup

In this section, we use the values of the coefficients obtained from the estimation in section 3.2 to estimate the impact of changes in the debt ratio on the debt interest rate. The results of the estimation also be used to discuss the optimal debt ratio for real estate investment. It is difficult to obtain enough data to conduct a statistical analysis of the debt ratio of a real estate fund and the fund's debt interest rate. Therefore, we use as proxy variables the debt ratios of U.S. listed companies, including those in the real estate sector, and the level of credit spread (Option Adjusted Spread, OAS) corresponding to the rating level of the company in question.

Figure 3 shows the OAS for U.S. corporate bonds by rating level, and the trend of the OAS since 1999 shows that the higher the rating, the lower the OAS level, and the lower the rating, the higher the OAS level.



(Source: Authors' compilation from FRED ECONOMIC DATA)

Figure 3: Trend of OAS

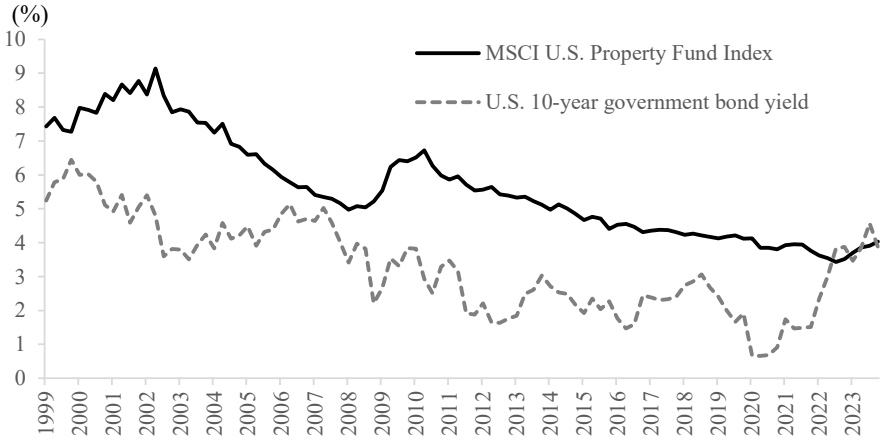
In addition, the OAS has expanded and contracted in response to business cycles and financial market shocks. For example, the OAS has expanded during the U.S. recession since 2001, the global financial crisis through 2009, and the European crisis triggered by Greece around 2012. OAS also expanded during the 2016 referendum on Britain's exit from the European Union (Brexit), the U.S. presidential election in 2016, and the global spread of the COVID-19 in 2020. Since OAS is the interest rate added to the treasury yield based on the credit quality of the company, we used the U.S. 10-year government bond yield plus OAS as the debt interest rates in our estimations.

Next, the MSCI/PREA U.S. ACOE Quarterly Property Fund Index (hereinafter referred to as "MSCI U.S. Property Fund Index") is used as the real estate fund return data. The MSCI U.S. Property Fund Index shows the income returns of core strategy and diversified real estate funds in the U.S.[1]. Figure 4 shows the trends of the MSCI U.S. Property Fund Index and the U.S. 10-year government bond yield since 1999.

The MSCI U.S. Property Fund Index rose to about 9% in 2003, then declined until 2009, after which the level has been gradually declining, although it temporarily recovered to around 7%. The U.S. 10-year government bond yield declined from over 6% in 2000 to below 1% in 2020, and then rose to over 5% after 2022.

The income return on real estate reflects the economic and financial environment up to that point in time, and is a so-called "backward-looking" value. On the other hand, the U.S. 10-year government bond yield is a "forward-looking" value that reflects forecasts for the future economic and financial environment, and

[1] The MSCI U.S. Real Estate Fund Index was used in this analysis due to data availability. However, the concept of improving returns through aggressive use of leverage is more appropriate for real estate investments in real estate funds that aim for high returns by giving managers more discretion (opportunity funds) than in core strategy and diversified real estate funds (core funds), which are covered by the MSCI U.S. Real Estate Fund Index. Opportunity funds are more likely than core funds to have higher returns than core funds. Opportunity funds are expected to generate somewhat higher returns than core funds, so the nature of real estate funds should also be considered when examining the relationship between debt ratios and real estate fund returns in the future.



(Source: Authors' compilation from Factset and MSCI)

Figure 4: MSCI U.S. Property Fund Index and U.S. 10-Year Government Bond Yield

caution should be exercised when making comparisons with the MSCI U.S. Property Fund Index at the same point in time. In fact, the figure shows that the U.S. 10-year government bond yield tends to move ahead of the MSCI U.S. Property Fund Index.

Using the above data, we make two estimates. Section 4.2 checks how the level of OAS changes when the debt ratio changes. We identify differences in changes by rating and at three points in time that reflect the expansion and contraction phases of the OAS. In section 4.3, we assume that the return on a real estate fund is the return on the MSCI U.S. Property Fund Index, and use time series data to check to what extent the investment return received by institutional investors changes when the debt ratio of that real estate fund changes.

4.2 Debt ratio and level of OAS

This section examines the extent to which the increase in the debt ratio affects the OAS level. We estimate the impact of the OAS level on the rating that can be obtained as of August 31, 2023, when compared to the OAS level as of August 31, 2023. In addition, we utilized the OAS level as of March 1, 2024, which reflects recent market trends, and March 23, 2020, when the financial markets are disrupted by the COVID-19 pandemic.

Table 5 shows the level of OAS for each rating according to the debt ratio of the companies. (a) is the OAS as of August 31, 2023, (b) is the OAS as of March 1, 2024, and (c) is the OAS as of March 23, 2020. First, we confirm that according to the estimation results in (a), the relationship between the estimated OAS increases by 1 bps for every 10% increase in the debt ratio for Aa- and A-rated companies. For example, if the debt ratio of an Aa-rated company increases from 35% to 40%, the OAS increases from 0.58% to 0.59%. The OAS expansion for a 10% increase in debt ratio is 1-2 bps for a Baa1 rating, 4-5 bps for a Baa2 rating, and 5 bps for a Baa3 rating, confirming that the lower the rating, the larger the OAS expansion.

Next, in (b) as of March 1, 2024, which reflects recent market trends, the range of change in OAS for

Aa- to Baa2-rated companies is generally the same as in (a). On the other hand, the range of change for the Baa3 rating is 3 bps, which is smaller than in (a). it is plausible to consider that, although the lower the rating, the greater the fluctuation of the OAS level itself, during economic periods when the OAS declines overall, as in (b), the change in the OAS in relation to the debt ratio is also suppressed.

As of March 23, 2020 (c), when the overall level of OAS was expanding, the change in OAS expanded for each of the ratings. For a 10% increase in the debt ratio, the OAS expanded by 1-2 bps for the Aa rating, 4 bps for the A rating, 5-6 bps for the Baa1 rating, 6-7 bps for the Baa2 rating, and 56 bps for the Baa3 rating. As in (b), in (c), the lower the rating during the OAS expansion phase, the greater the sensitivity of the OAS increase to the debt ratio increase.

As described above, we confirm that the range of change in OAS as a function of debt ratio varies from rating to rating, and is also affected by the business cycles.

Table 5: OAS according to debt ratio levels

Ratings	Estimated OAS by debt ratios						Average debt ratio
	30%	35%	40%	45%	50%	55%	
Aa	0.57	0.58	0.59	0.60	0.61	0.62	55.62
A	0.94	0.95	0.96	0.97	0.99	1.00	62.30
Baa1	1.14	1.16	1.17	1.19	1.21	1.23	69.62
Baa2	1.14	1.18	1.23	1.28	1.33	1.38	63.35
Baa3	1.68	1.73	1.78	1.82	1.87	1.92	62.58

(a) OAS as of August 31, 2023

Ratings	Estimated OAS by debt ratios						Average debt ratio
	30%	35%	40%	45%	50%	55%	
Aa	0.50	0.51	0.52	0.52	0.53	0.54	55.62
A	0.77	0.78	0.79	0.80	0.81	0.82	62.30
Baa1	0.94	0.96	0.97	0.98	1.00	1.01	69.62
Baa2	0.96	1.00	1.03	1.07	1.11	1.15	63.35
Baa3	1.39	1.42	1.46	1.49	1.53	1.57	62.58

(b) OAS as of March 1, 2024

Ratings	Estimated OAS by debt ratios						Average debt ratio
	30%	35%	40%	45%	50%	55%	
Aa	2.61	2.63	2.64	2.66	2.67	2.69	55.62
A	3.01	3.05	3.09	3.13	3.17	3.21	62.30
Baa1	3.67	3.72	3.78	3.84	3.89	3.95	69.62
Baa2	3.64	3.80	3.96	4.13	4.29	4.45	63.35
Baa3	5.46	5.61	5.77	5.92	6.07	6.23	62.58

(c) OAS as of March 23, 2020

(Source: Prepared by the authors)

4.3 Debt Ratios and Real Estate Fund Returns

In this section, we use time series data to identify changes in the return on investment in a real estate fund received by institutional investors when the debt ratio of the real estate fund changes, even for the same real estate fund return. This allows institutional investors to build models to monitor the extent to which real estate funds are operating with an optimal debt ratio in mind. As pointed out in section 4.1, the MSCI U.S. Real Property Fund Index returns differ from the U.S. 10-year government bond yield in terms of whether the information reflected is "backward-looking" or "forward-looking". However, for the sake of simplicity in this analysis, the debt interest rate corresponding to the MSCI U.S. Property Fund Index return in period t is the U.S. 10-year government bond yield plus the OAS in period t.

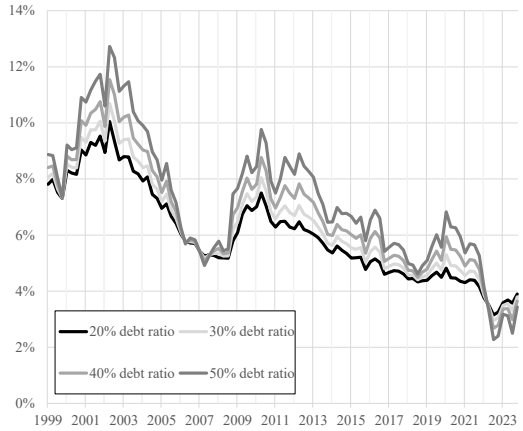
Figure 5-1(a)-(c) shows the investment returns from real estate funds received by institutional investors, by rating, for real estate acquisitions with debt ratios between 20% and 50% from the first quarter of 1999 to the fourth quarter of 2023. Each figure represents the level of investment returns. In (a), which covers Aa ratings, investment returns are 10.0% for a 20% debt ratio and 12.7% for a 50% debt ratio in the second quarter of 2002, followed by a 5.2% return for a 20% debt ratio and a 5.5% return for a 50% debt ratio in the third quarter of 2008. After rising to 7.5% to 9.8% over the second quarter of 2010, investment returns have gradually declined.

Since 1999, real estate fund returns have generally exceeded the debt interest rate, so that the higher the debt ratio, the higher the investment return. The trend in (b) for A-rated assets is generally similar to that for Aa-rated assets. In (c), the investment returns for all debt ratios are lower than in (a) and (b) for Baa-rated loans.

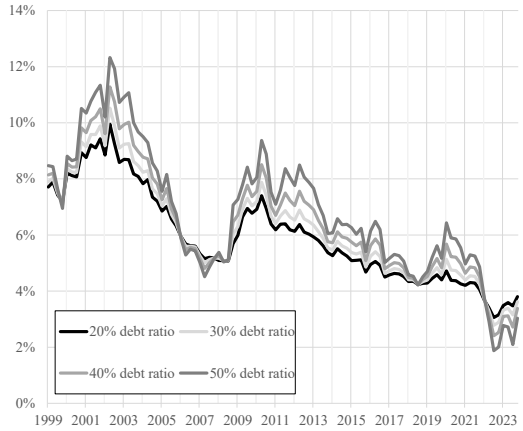
We can also confirm this trend in Figure 5-2, which shows the excess return on leveraged fund versus no leverage fund. In (a), which shows the excess return from Aa-rated leveraged fund, is about 1% for a 20% debt ratio in 2002 and about 4% for a 50% debt ratio. In the same time, in A-rated (b), the excess return is about the same for a 20% debt ratio with (a) and 3.5% for a 50% debt ratio, which is lower than that of (a). On the other hand, during the same period when the Baa rating (c) is assigned, the excess return is less than 1% when the debt ratio is 20% and less than 3% when the debt ratio is 50%, confirming that the cost of the debt interest rates increases with a lower rating compared to (a) and (b), pushing down the excess return. From 2006 to 2008, the negative excess return is about -1% larger for (b) than for (a) when the debt ratio is 50%, and even more than -1% for (c). Subsequently, even after 2009, the higher the rating, the greater the upside of the excess return and the smaller the downside is shown.

Figure 6-1 shows real estate investment returns by rating for each debt ratio level. In (a) through (c), the higher the debt ratio, the greater the boost to earnings from leverage. Figure 6-2 shows excess returns from leverage by rating for each debt ratio level. In (a) through (c), the volatility of the excess return from leverage of real estate funds is greater as the debt ratio increases. Figures 6 show that the higher the rating, the greater the upside, and the more restrained the downside.

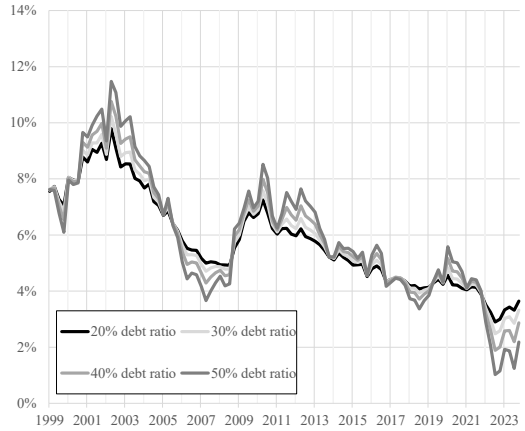
The above analysis indicates that leverage to increase the debt ratio can increase the range of excess return compared to the case where no leverage. In addition, higher credit ratings suppress the debt interest rate, thereby increasing the return for institutional investors. Through the estimation process, we develop a model for institutional investors to monitor the extent to which real estate funds are managing their



(a)Aa Rating



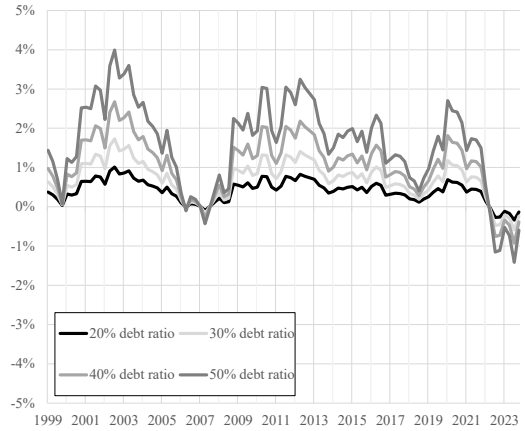
(b) A Rating



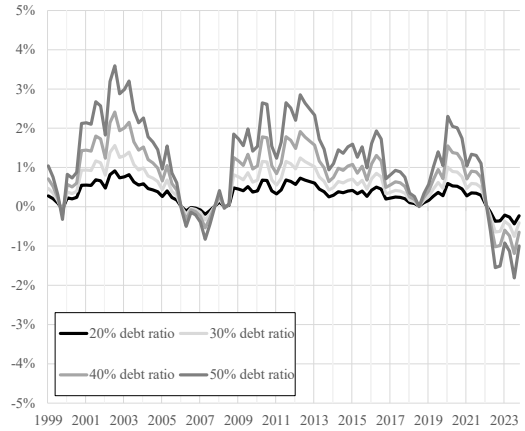
(c)Baa Rating

(Source: Compiled by the authors from Factset, FRED ECONOMIC DATA, and MSCI)

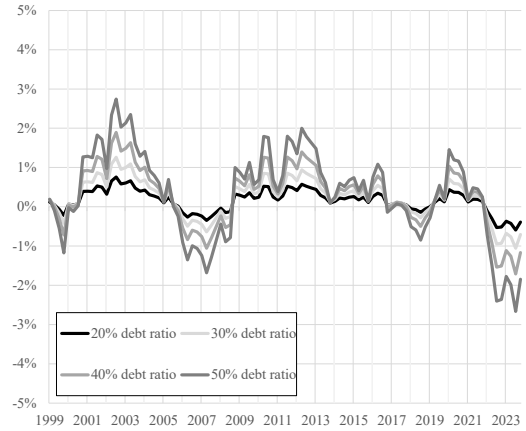
Figure 5-1 Debt Ratio and Real Estate Fund Returns (Level)



(a)Aa Rating



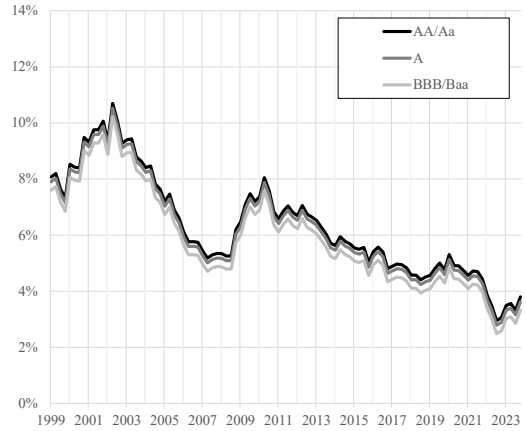
(b) A Rating



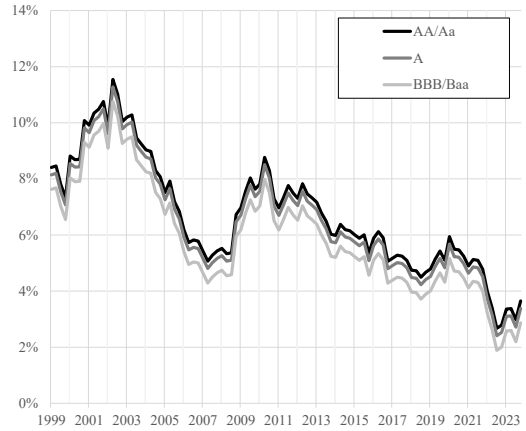
(c)Baa Rating

(Source: Compiled by the authors from Factset, FRED ECONOMIC DATA, and MSCI)

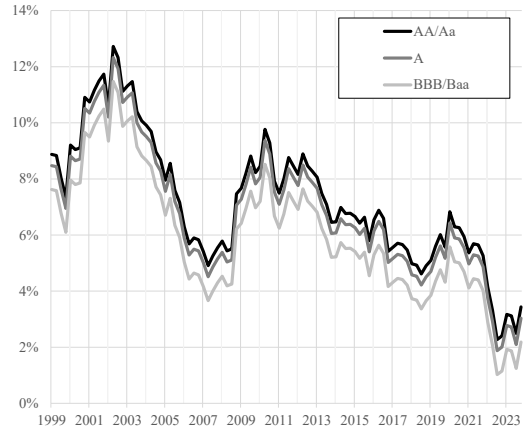
Figure 5-2 Debt ratios and real estate fund returns (excess return due to leverage)



(a) 30% debt ratio



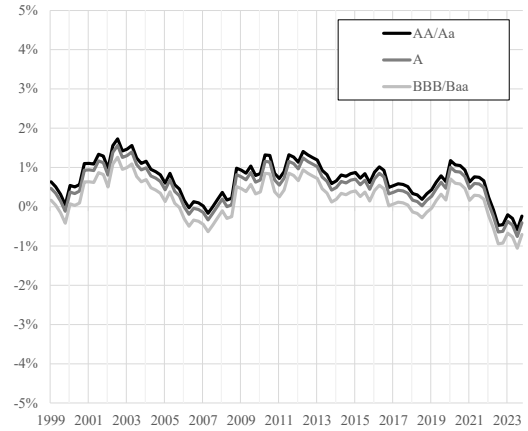
(b) Debt ratio 40%



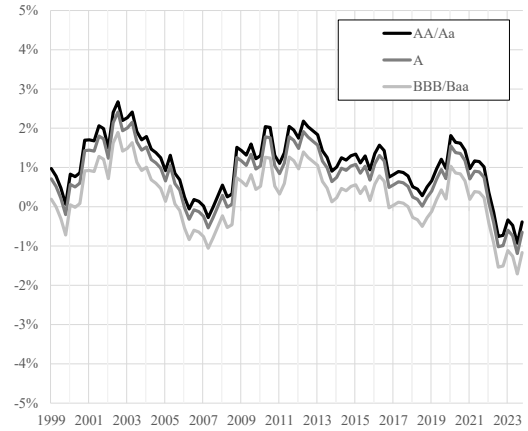
(c) Debt ratio 50%

(Source: Compiled by the authors from Factset, FRED ECONOMIC DATA, and MSCI)

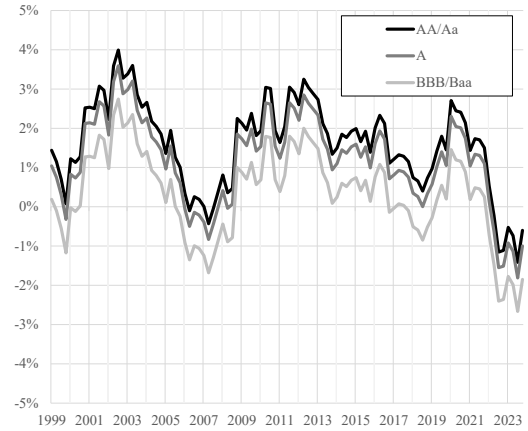
Figure 6-1 Debt Ratios and Real Estate Fund Returns (Levels)



(a) 30% debt ratio



(b) Debt ratio 40%



(c) Debt ratio 50%

(Source: Compiled by the authors from Factset, FRED ECONOMIC DATA, and MSCI)

Figure 6-2 Debt ratios and real estate fund returns (excess return due to leverage)

investments with an awareness of optimal debt ratios. In this analysis, the MSCI U.S. Property Fund Index is used as a proxy variable for real estate fund returns, which originally differed by portfolio property. We then estimate how the investment returns received by institutional investors would change if the ratings and debt ratios of the real estate fund are changed. Therefore, a strong assumption is made that real estate fund returns are the same for all ratings and debt ratios, and actual investments require analysis that reflects the individual characteristics of the real estate properties in which they invest.

5. Summary and future issues

Based on an ordered logit/probit model with financial indicators including debt ratios as explanatory variables and quantified rating levels as explained variables, this study discussed the impact of debt ratios on latent variables that determine rating levels. Next, we estimated the impact of debt ratios on real estate fund debt interest rates and real estate fund returns.

The results of the estimation using the ordered logit/probit model indicated that in addition to the size and profitability indicators, the debt ratio indicator focused on in this analysis significantly affects the level of the rating. The results confirmed that the degree of influence of the level of debt ratio on the OAS is greater the lower the rating. It was also shown that the impact of the debt ratio on the OAS differs depending on whether the corporate bond market as a whole has a wide or tight OAS depending on the economic and financial environment. Next, an estimation of the effect of the debt ratio on the investment returns of institutional investors in real estate funds showed that since 1999, real estate fund returns have generally exceeded the debt interest rates, indicating that returns increase as the debt ratio increases. However, when monetary policy is tightened, borrowing costs increase, pushing down investment returns when debt ratios are high. The increase in the debt interest rates is large when the credit rating is low, confirming that the downward effect of higher borrowing costs on investment returns during the tightening phase is as large as the upward effect on the excess return obtained through leverage.

Based on the above results, when institutional investors invest in real estate funds, an increase in the debt ratio of the fund can be expected to boost returns. On the other hand, if the real estate fund has a low credit rating, the increase in borrowing costs due to a higher debt ratio should be taken into account to have a commensurately large downward effect on investment returns. In addition to the rating and debt ratio of the borrower, the debt interest rates are also affected by the monetary policy cycle, so it is advisable to time one's entry into the market.

We discuss future issues for this analysis. In this analysis, debt ratios of listed companies, including those in the real estate sector, and OAS were used as proxy variables for debt interest rates based on the credit quality of real estate funds. In addition, the MSCI U.S. Property Fund Index, which captures income returns from portfolio properties in core funds, was used as the return on real estate funds. Therefore, it does not capture the effect of capital gains from rising real estate property prices, nor does it take into account the level of yield of opportunity funds that seek to increase returns through borrowing (leverage). Furthermore, the analysis neglects the individual nature of the properties in which they are invested. In addition, this analysis uses data from the same time period to estimate the income return of real estate funds, which is a

"backward-looking" measure, and the yield on U.S. 10-year government bonds and OAS, which are "forward looking" measures of the debt interest rates. Therefore, for a more practical analysis, it is preferable to use return data that includes actual real estate fund debt ratios and debt interest rates, as well as capital returns. It will also be necessary to consider in the future how to handle the difference in nature between real estate fund returns ("backward-looking") and debt interest rates ("forward-looking").

In addition to the above, one of the objectives of this analysis is to enable a causal analysis of the relative value between the return on real estate funds and the return on U.S. corporate bond investments. For example, when comparing investment opportunities in corporate bonds and real estate funds, in a phase of widening credit spreads, the yield obtained by investing in corporate bonds increases, while the return from leverage in real estate funds decreases due to higher borrowing rates. When institutional investors consider investing in real estate funds, they will need to conduct relative value analysis based on the impact on investment returns through such debt interest rates. Through efforts to make these analyses practical, it is hoped that real estate investments, which are considered alternative assets, will be subject to active discussion based on quantitative analysis in the same way as traditional assets such as stocks and bonds.

References

[1] Brennan, M. and Schwartz, E. (1978) Finite Difference Methods and Jump Processes Arising in the Pricing of Contingent Claims: A Synthesis. Journal of Financial and Quantitative Analysis, 13, 461-474. https://doi.org/10.2307/2330152

[2] Damodaran, J. (2001), Corporate Finance: Strategies and Applications, Toyo Keizai Inc.

[3] Kitamura, Yukinobu (2009), Introduction to Micro-Econometrics, Nippon Hyoronsha.

[4] Kobayashi, M. (2001), "Testing an ordinal probit model and its application to corporate bond rating data", Journal of Financial Research, Vol. 20, Supplement No. 1.

[5] Kokubo, H. and K. Miyazaki (2005), "An examination of the optimal capital structure of Japanese firms", Bulletin of the University of Electro-Communications, Vol. 17, No. 1 & 2, pp. 11-20.

[6] Leland, E. H. (1994) Corporate Debt Value, Bond Covenants, and Optimal Capital Structure, The Journal of Finance, 49(4), 1213-1252. https://doi.org/10.2307/2329184

[7] Leland, E. H. and Toft, B. K. (1996) Optimal Capital Structure, Endogenous Bankruptcy, and the Term Structure of Credit Spreads, The Journal of Finance, 51(3), 987-1019. https://doi.org/10.1111/j.1540-6261.1996.tb02714.x

[8] Miller, M. and F. Modigliani (1961) "Dividend Policy, Growth and the Valuation of Shares," Journal of Business, Vol. 34, 411-443.

[9] Niimi, T. (1998), "The Relationship between Credit Ratings and Financial Indicators," Jaffee Journal 1998, 37-66.

[10] Tsuchiya, D. (2017), "Pursuit of Optimal Capital Structure and Rating Strategies - Toward Advanced Financial Strategies," KPMG Insight Vol. 26 (URL: https://kpmg.com/jp/ja/home/insights/2017/09/capital-structure- 20170915.html, accessed May 17, 2024).