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Research on the Financial Risk of Real Estate Enterprises Based on Idiosyncratic Volatility

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Abstract: The real estate industry is characterized by high financial leverage, making the analysis and accurate assessment of its financial risks particularly important. This study aims to examine the relationship between idiosyncratic volatility and the short-term solvency of real estate enterprises. By applying the Analytic Hierarchy Process (AHP), this study quantifies short-term solvency and constructs a linear regression model. Empirical analysis reveals a significant positive correlation between idiosyncratic volatility and solvency. This finding provides important insights for understanding and predicting the idiosyncratic volatility of real estate enterprises and offers a new perspective for regulatory and evaluation agencies in assessing real estate enterprises.

Keywords: idiosyncratic volatility, real estate industry, solvency, risk management

1. Introduction

In recent years, China's real estate market has experienced unprecedented volatility. The real estate prosperity index has fallen to a historical low, delivering a severe blow to the industry. Against this backdrop, research on the financial stability of the real estate sector—particularly the solvency of enterprises—has become increasingly important.

Idiosyncratic volatility, as an indicator measuring firm-specific risk, may have a significant impact on the solvency of enterprises in the real estate industry. Therefore, this study aims to explore the relationship between idiosyncratic volatility and the solvency of real estate enterprises, providing a theoretical foundation for enhancing the financial stability of the industry and informing government regulation.

Based on the above background, this study proposes the following hypothesis: there is a negative correlation between idiosyncratic volatility and the solvency of real estate enterprises.

To test this hypothesis, this study employs a linear regression model, using idiosyncratic volatility as the independent variable and corporate solvency as the dependent variable, conducting an empirical analysis. Through data analysis of listed real estate companies in China, this study seeks to identify the specific impact of idiosyncratic volatility on the solvency of real estate enterprises, as well as differences in this effect among different types and sizes of enterprises.

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2. Theoretical Analysis and Research Hypotheses

2.1. Solvency of Real Estate Enterprises

As a capital-intensive and highly leveraged industry, the solvency of real estate enterprises has long been a focus of research. Compared with studies abroad, scholars such as Fitzpatrick [1] and Altman [2] made early contributions in the twentieth century to the theoretical research on financial risk assessment in the real estate sector. In China, Sheng Guangming and Zhou Hui [3] applied the Z-score model in their empirical research and proposed constructive ideas in this field. More recently, Qi Jiayong and Cai Yongbin [4] developed a relatively comprehensive financial risk evaluation model for real estate enterprises based on factor analysis. Li Zhengbin [5] further evaluated short-term solvency and identified shortcomings in existing assessment models.

2.2. Idiosyncratic Volatility

The so-called “idiosyncratic volatility puzzle” was first discovered by Ang et al. [6] through their study of stock data. Their findings run counter to the traditional Capital Asset Pricing Model (CAPM) and the incomplete information theory proposed by Merton [7]. At present, scholars such as Lu Rong and Yang Kang [8], Hu Xiaoxin [9], and Zhang Jing [10] have provided explanations for the causes of the idiosyncratic volatility puzzle from the perspective of behavioral finance. In addition, a large number of scholars have dedicated themselves to studying this anomaly. Since 1993, when Fama and French [11] introduced the three-factor model to explain stock returns, they further expanded the model into a five-factor framework in 2013 [12].

However, there is still no simple and convenient model available to conduct a preliminary assessment of the short-term solvency of real estate enterprises. Therefore, introducing idiosyncratic volatility into the research framework for solvency analysis provides a new analytical dimension for evaluating the debt repayment risk of real estate enterprises by exploring the intrinsic relationship between the two variables.

2.3. Research Hypotheses

Given the lack of studies on the relationship between idiosyncratic volatility and corporate solvency, this research attempts to indirectly analyze their relationship by focusing on several key indicators of short-term solvency.

When assessing whether a company is of high quality, evaluating its solvency is a crucial aspect. Idiosyncratic volatility reflects the uncertainty faced by an enterprise, which may affect its operational efficiency and innovation capability, thereby influencing its ability to repay debts. Accordingly, the following hypothesis is proposed:

H1: Idiosyncratic volatility of real estate enterprises is significantly correlated with their solvency.

Moreover, higher idiosyncratic volatility often indicates greater exposure to operational risk, which may lead to increased debt repayment costs and ultimately affect solvency. Therefore, the second hypothesis is proposed:

H2: Idiosyncratic volatility is significantly and positively correlated with corporate operational risk.

3. Data and Research Methodology

3.1. Sample Selection

In order to accurately reflect the current state of development while avoiding the impact of external economic factors—such as those stemming from the pandemic period—on real estate enterprises, and

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the market price instability caused by investor sentiment immediately following the end of the pandemic, this study selects data spanning a two-month period from April 1, 2023, to May 31, 2023, covering a total of 39 trading days. Notably, the selected sample period coincides with the quarterly reporting season. The sample comprises 53 non-ST real estate companies listed on the Shanghai A-share market (classified according to the 2012 CSRC industry classification). First, the Shanghai A-share market represents a significant segment of China's stock market. Selecting real estate enterprises from this market ensures industry representativeness and provides an accurate reflection of the development status of China's real estate sector. Moreover, the information disclosure of listed companies on the Shanghai A-share market is relatively standardized, which significantly reduces one of the primary factors influencing idiosyncratic volatility—information asymmetry. This enhances the reliability of the conclusions drawn.

3.2. Variable Selection

Table 1: Variable Definitions

Variable Name	Symbol	Definition
Return	$r_{i,t}$	Individual stock return minus the risk-free rate, where the risk-free rate is represented by the government bond repo rate
Market Return	MKT	Daily market return with reinvested cash dividends (weighted by total market capitalization)
Size Factor	SMB	Return differential based on the Fama-French classification by market capitalization and book-to-market ratios into six groups
Book-to-Market Factor	HML	Return differential based on the Fama-French classification by market capitalization and book-to-market ratios into six groups
Idiosyncratic Volatility	iv	Standard deviation of the residuals obtained from the factor model fitting
Current Ratio	CR	Current Assets / Current Liabilities
Quick Ratio	QR	Quick Assets / Current Liabilities
Cash Ratio	CaR	Cash and Cash Equivalents / Current Liabilities

3.3. Variable Calculation

3.3.1. Idiosyncratic Volatility

This study primarily adopts the Fama-French three-factor model for calculation. First, the Fama-French three-factor model has a long history and has been rigorously tested by numerous scholars, demonstrating good model performance. Compared with the CAPM, it provides a more precise analysis of assets. Second, for analyzing short-term idiosyncratic volatility in enterprises, our primary goal is to capture the idiosyncratic risk of real estate enterprises; thus, employing a model with more factors for increased precision is unnecessary.

Accordingly, this study calculates idiosyncratic volatility based on the three-factor model and methodology proposed by Fama and French in 1993:

$$r_{i,t} = \alpha_i + \beta_{MKT,t} MKT + \beta_{SMB,t} SMB + \beta_{HML,t} HML + \epsilon_{i,t} \quad (1)$$

After obtaining the residuals from the three-factor model, these residuals are further processed to derive idiosyncratic volatility:

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$$iv = 100 \times \sqrt{\frac{\sum_1^t \epsilon_{i,t}}{T-4}} \times \sqrt{242} \quad (2)$$

In 2023, there are a total of 242 trading days. The coefficient multiplier annualizes the idiosyncratic volatility to facilitate better analysis.

3.3.2. Solvency

With respect to short-term solvency, Li Zhengbin [5] suggested that the short-term solvency of real estate enterprises can be assessed by focusing on three key indicators: quick ratio, cash ratio, and current ratio. Based on the calculation and methodology of the Analytic Hierarchy Process (AHP) presented by Deng Xue et al. [13], this study applies AHP to analyze the solvency indicators, thereby quantifying solvency and enabling more effective evaluation in relation to idiosyncratic volatility.

The AHP-based model follows four progressive steps:

Step 1: Construct the Hierarchical Model

The target level in this study is solvency, which will be comprehensively evaluated from three aspects: current liabilities, illiquid inventories, and cash coverage of debts. The criteria level consists of the three key indicators for measuring the short-term solvency of real estate enterprises proposed by Li Zhengbin [5]: current ratio, quick ratio, and cash ratio.

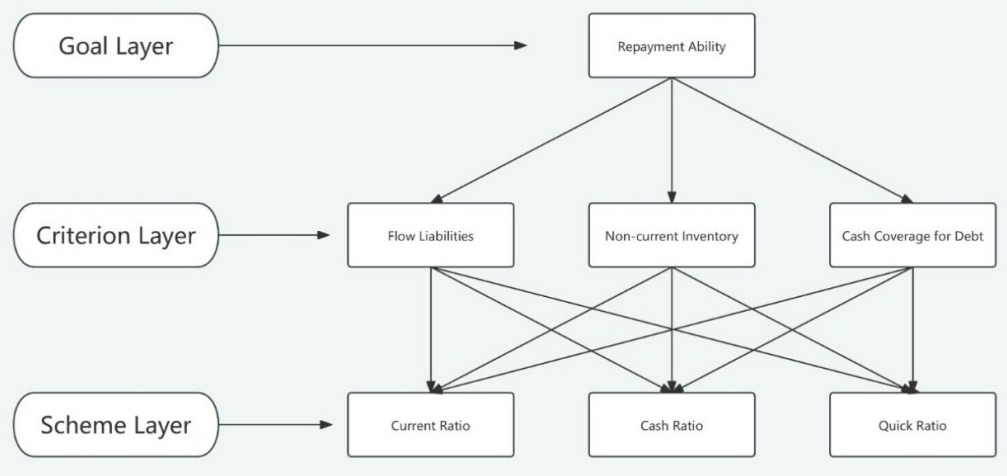


Figure 1: Hierarchical Model of Short-Term Solvency Analysis

Step 2: Construct the Pairwise Comparison Matrix for Each Level

The current ratio considers all current assets, including inventories with relatively slow liquidity; the quick ratio excludes inventories and other less liquid assets; and the cash ratio only considers cash and cash equivalents. These three indicators, progressing from lenient to stringent, gradually reflect an enterprise's short-term solvency. Therefore, it is determined that the cash ratio is more important than the current ratio, and the quick ratio is slightly more important than the current ratio. Based on this reasoning, the following pairwise comparison matrix is constructed:

Table 2: Pairwise Comparison Matrix

	Current Ratio	Quick Ratio	Cash Ratio
Current Ratio	1	3	5
Quick Ratio	1/3	1	3
Cash Ratio	1/5	1/3	1

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Step Three: Consistency Check

(1) The consistency index (CI) is calculated using the following formula:

$$CI = \frac{\lambda_{max} - n}{n-1} \tag{3}$$

(2) According to the random consistency index (RI), when n = 3, the RI value is 0.53. Based on this, the consistency ratio (CR) can be calculated as follows:

$$CR = \frac{CI}{RI} \tag{4}$$

After calculation, the consistency index (CI) of the judgment matrix is 0.0193, and the consistency ratio (CR) is 0.037. Since the CR value is less than 0.1, it indicates that the consistency of the judgment matrix is acceptable.

Step Four: Weight Calculation

The weights are determined by using the eigenvector method and the arithmetic mean method to calculate the average values. According to the weight distribution of each indicator, the current ratio has the largest weight at 0.6352; the quick ratio ranks second at 0.2594; and the cash ratio has the smallest weight at 0.1054. The total of these three indicator weights equals 1, forming a complete index weight system.

Based on the weights derived from the analytic hierarchy process (AHP), the quick ratio, current ratio, and cash ratio are each multiplied by their respective weights and then summed. The resulting value is then subjected to data standardization using the following formula:

$$Z = \frac{X - \mu}{\sigma} \tag{5}$$

4. Empirical Results and Analysis

This section presents the results of the empirical analysis conducted using Stata software, including descriptive statistics, correlation analysis, baseline regression analysis, heterogeneity analysis, and robustness tests.

4.1. Descriptive Statistics

First, a descriptive statistical analysis was conducted on the sample data. Table 3 presents the basic statistical information of the variables. These statistics provide a preliminary understanding of the data distribution and central tendency.

Table 3: Descriptive Statistics

Variable	Mean	SD	Min	Max
Idiosyncratic Volatility	26.64486	10.02587	12.5116	52.69279
Short-term Solvency	0	1	-0.8038331	4.900423

Overall, the wide variation in idiosyncratic volatility indicates that the specific risk under examination has been effectively captured. No further classification or screening was conducted for these 53 companies during sample selection, which enhances the representativeness of the short-term solvency data across the entire industry and avoids the confounding effects of factors such as firm size.

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4.2. Baseline Regression Analysis

The purpose of the baseline regression analysis is to evaluate the impact of the independent variable on the dependent variable. A linear regression model was employed, and the results are shown in Table 4. The findings reveal a significant positive correlation between the independent and dependent variables.

Table 4: Baseline Regression Analysis

Variable	Baseline Regression		Robustness Test	
	Coefficient	Std. Error	Coefficient	Std. Error
Solvency	3.905783	1.29299	3.9058	1.1277
_cons	26.64486	1.280734	26.6449	1.2807

Note: The R^2 of both regressions is 0.1518. The t-value of the baseline regression is 3.02 ($p < 0.004$), and the t-value of the robustness test is 3.46 ($p < 0.001$).

This study explores the effect of solvency on idiosyncratic volatility through a linear regression model. The results indicate that solvency has a significant positive impact on idiosyncratic volatility. Specifically, the coefficient of solvency is 3.905783 (with a standard error of 1.29299), which is statistically significant. Therefore, the null hypothesis can be rejected, and it can be concluded that the coefficient of solvency is significantly different from zero.

The constant term of the model indicates that, when solvency is not considered, the baseline level of idiosyncratic volatility is 26.64486. The result of the constant term is also statistically highly significant.

In summary, this study confirms the significant positive impact of solvency on idiosyncratic volatility, and the overall fit of the model is satisfactory. These findings provide important insights for understanding and predicting idiosyncratic volatility.

4.3. Robustness Test

To ensure the reliability of the regression results, robustness tests were conducted to evaluate the model's sensitivity to heteroscedasticity. Heteroscedasticity refers to the variance of the error terms changing with the independent variables, which may affect the validity of ordinary least squares (OLS) estimation and hypothesis testing. To address this issue, robust standard errors (HC heteroscedasticity-consistent standard errors) were employed for the regression analysis.

In the robustness test, it was found that the positive impact of solvency on idiosyncratic volatility remains significant after accounting for heteroscedasticity. The four numerical values of the constant term indicate its strong statistical significance. The model explains approximately 15.18% of the variation in idiosyncratic volatility. The root mean square error (Root MSE) is 9.3239, providing a measure of the model's prediction error.

By applying robust standards, the regression results exhibit a high degree of robustness to heteroscedasticity. This indicates that the findings are unlikely to be solely attributable to heteroscedasticity but rather reflect the genuine relationship between solvency and idiosyncratic volatility. Consequently, solvency can be identified as an important factor influencing idiosyncratic volatility.

5. Conclusion and Recommendations

The findings confirm a positive correlation between idiosyncratic volatility and short-term solvency in real estate enterprises. Although the scope of the research is limited to the overall trend within the real estate industry, the quantitative evaluation of short-term solvency based on the analytic hierarchy

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process (AHP) and the results of the linear regression model indicate that idiosyncratic volatility is an indicator that warrants attention.

At the practical level, it is recommended that enterprises establish a daily monitoring mechanism for idiosyncratic volatility and integrate it into their risk management systems. Regulatory authorities are advised to consider idiosyncratic volatility as a key regulatory indicator, particularly for systemically important real estate enterprises. Regulatory standards should be developed, requiring the periodic disclosure of relevant data to enable the market to identify risks in a timely manner.

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