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The Impact of Financial Leverage on Corporate Profitability : An Empirical Analysis Based on Real Estate Listed Companies on Shenzhen Main Board

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ABSTRACT
This study employs panel data from Shenzhen Main Board real estate listed companies spanning 2021-2024 to empirically analyze the impact of financial leverage on profitability. Using the logarithm of return on assets (lnROA) as the dependent variable and the logarithm of leverage (lnLeverage) as the core independent variable, we incorporated firm size (Size) and capital intensity (Capital Intensity) as control variables to construct a multiple linear regression model. The analysis conducted using SPSS reveals a significant positive correlation between financial leverage and profitability, indicating that increased leverage levels paradoxically enhance earnings performance within this sample. Notably, neither firm size nor capital intensity demonstrated significant explanatory power for profitability, suggesting their explanatory significance remains limited at the current stage of analysis.

KEYWORDS
Financial leverage; Profitability; Capital structure; Real estate listed companies

1 Introduction

When analyzing the financial data of Shenzhen-listed real estate companies on the main board from 2021 to 2024, a striking contrast emerges in their debt levels. Some firms have seen continuous expansion of debt scale with rising leverage ratios, while others have opted to control debt and maintain prudent operations. The fundamental question is whether these divergent approaches to leverage strategies ultimately impact profitability, particularly their effect on Return on Assets (ROA) which forms the core focus of this study. Given the inherent distribution characteristics of the data, logarithmic transformations were applied to both ROA and leverage ratio in subsequent analyses, with lnROA and lnLeverage serving as the primary variables [1-2].

While the relationship between capital structure and profitability has been extensively studied by scholars, current findings remain inconclusive. Some literature suggests that appropriate debt ratios can enhance profitability, while others reveal that excessive leverage may erode profits through higher interest costs, ultimately reducing earnings [3-5]. Additionally, corporate characteristics such as firm size and capital intensity might influence both the direction and extent of how leverage affects profitability [6].

Given the relatively large scale of real estate companies listed on Shenzhen's main board and their significant sensitivity to macroeconomic regulation in financing methods, I selected data from these listed firms spanning 2021-2024. Through regression analysis, I empirically examined the relationship between financial leverage and profitability [2], while incorporating control variables such as firm size and capital intensity into the model to better identify the true impact of leverage.

2 Theoretical basis and literature review

2.1 Basic theory of the relationship between capital structure and profitability

Discussions about capital structure and corporate value can be traced back to the capital structure-independent theory proposed by Modigliani and Miller, which posits that under ideal market conditions, a company's capital structure does not affect its value. However, we observe that in actual operations, factors such as taxation, bankruptcy costs, and agency costs often influence corporate financing decisions, thereby affecting profitability. The trade-off theory suggests that while debt provides tax shield benefits, it also increases financial risks, requiring companies to balance these two aspects. Meanwhile, the pecking order theory explains that firms exhibit sequential preferences in financing decisions, typically prioritizing internal funding sources, followed by debt financing, and lastly equity financing.

The real estate industry is a typical high-leverage industry. Enterprise expansion and project development are generally dependent on debt financing, and the rationality of capital structure is directly related to the profitability and operational safety of enterprises. Under this background, the relationship between financial leverage and profitability is particularly worthy of attention.

2.2 Domestic and foreign research status and literature review

Empirical studies on capital structure and profitability have been extensively explored by scholars from various perspectives. Research indicates that moderate leverage can enhance corporate profitability. Ma Juan Ying and Zhang Lian Yao (2024) demonstrated in their analysis of Company M's capital structure that appropriate debt ratios improve capital utilization efficiency [5]. Wang Jing and Zhang Yue (2015), through a sample study of real estate listed companies, also found that optimized capital structures can partially improve financial performance [2].

Conversely, other studies suggest that high leverage levels may compress corporate profit margins and increase financial burdens. Lu Tingting (2024) found in her research on the impact of futures companies' financial leverage on profitability that excessive debt ratios weaken corporate profitability [4]. Similar conclusions were also observed in Liao Xueying's (2024) study on listed companies' capital structure [3]. Dao, Binh Thi Thanh, and Tram Dieu Ngoc Ta (2020) further demonstrated that capital structure generally shows a negative correlation with corporate performance, aligning with the views of agency cost theory and pecking order theory [7]. However, from a theoretical perspective, Tudose & Mihaela Brindusa (2012) present divergent perspectives: agency cost theory (considering tax shields and bankruptcy costs) tends to predict a positive correlation, while pecking order theory predicts a negative correlation. This divergence partially explains the diversity of empirical results [8].

Furthermore, some scholars argue that the relationship between capital structure and profitability may be moderated by characteristic variables such as firm size and capital intensity. In their study of agricultural listed companies, Liu Yu, Sun Mingzhen, and Wei Jinghong (2024) pointed out that firms with high capital intensity exhibit greater profit volatility under high leverage [6]; Zhang Xuechun (2024) also found in an empirical analysis of the pharmaceutical manufacturing industry that firm size differences play a significant role in capital structure moderation [9]. Xu Li and Wang Sihua (2024) further proposed in their research on ChiNext-listed companies that optimal capital structure ranges differ significantly across industries and life cycle stages [10]. Dao, Binh Thi Thanh, and Tram Dieu Ngoc Ta (2020) further confirmed through regression analysis that ROA/ROE, Tobin's Q, and the publication status of research papers serve as crucial moderating variables affecting the strength of capital structure-performance relationships, particularly regarding the selection of proxy variables for industry factors and firm performance [7].

2.3 The entry point of this study

In summary, while existing research has extensively discussed the relationship between capital structure and profitability, systematic empirical studies specifically targeting real estate listed companies on Shenzhen's main board and utilizing the latest panel data from 2021 to 2024 remain relatively scarce. Given that the real estate industry faces stringent policy regulations and generally high debt levels, financing decisions directly impact its profitability. Against this backdrop, this study selects real estate listed companies on Shenzhen's main board as research subjects to empirically analyze the actual relationship between financial leverage and profitability. It should be noted that during data processing, I applied natural logarithmic transformations to core variables (return on assets and financial leverage), denoted as lnROA and lnLeverage respectively, to ensure more robust modeling and closer normal distribution of variables [2]. Additionally, I introduced firm size and capital intensity as control variables [6], aiming to supplement and refine existing research frameworks.

3 Research design

This study investigates capital structure and profitability in Shenzhen Main Board-listed real estate companies. Given that property enterprises typically face capital-intensive operations, high leverage ratios, and policy regulation impacts, we adopt financial leverage (Leverage) as the core independent variable and return on assets (ROA) as the dependent variable, while controlling for firm size (Size) and capital intensity (Capital Intensity) [2,10]. Through a multivariate linear regression model, we empirically examine the relationship between leverage levels and profitability, while analyzing potential moderating effects of firm size and capital intensity in this dynamic relationship.

3.1 Sample selection, data source, and variable settings

This study focuses on real estate companies listed on the Shenzhen Stock Exchange's main board, with data covering 2021 to 2024 primarily sourced from the CSMAR database. The selection criteria include: (1) abundant sample size of large-scale enterprises with transparent financial disclosures; (2) the industry's high leverage dependency and frequent capital restructuring, making it representative for studying leverage-profit relationships; (3) Shenzhen's real estate market maintaining leading regulatory policies nationwide, which creates policy-sensitive financing behaviors among companies.

After organizing and supplementing partial missing or abnormal data, we obtained 356 valid observation sets involving 12 listed companies: Vanke A, Shenzhen Zhenye A, Shenzhen Property A, Shahe Co., Ltd., Shenzhen Tian Di A (ST Shen Tian, *ST Shen Tian), Shenzhen Shen Fang A, Joy City, Hualian Holdings, Zhongzhou Holdings, Huangting

International, and OCT A. Following data processing, all datasets were imported into SPSS software to serve as the foundation for subsequent empirical analysis.

In variable selection, considering the research focus on the direct relationship between leverage and profitability, I set the natural logarithm of return on assets (lnROA) as the dependent variable and the natural logarithm of financial leverage (lnLeverage) as the primary independent variable. To avoid excluding other corporate characteristics that may affect profitability, I also incorporated firm size (Size) and capital intensity (Capital Intensity) as control variables into the model. The specific variable settings are as shown in the table below:

Table 1 Variable definitions and measurement descriptions

Variable Type	Variable Name	Variable Symbol	Variable Meaning	Calculation Method
Dependent variable	Asset Return Rate	lnROA	Measures the profitability of an enterprise	The natural logarithm of the ratio of net profit to total assets
Primary Independent Variable	Financial Leverage	lnLeverage	Measures the level of a firm's financial leverage	The natural logarithm of the ratio of total liabilities to total assets
Control Variable	Firm Size	Size	Reflects the magnitude of the firm's asset scale	The natural logarithm of the firm's total assets
	Capital Intensity	Capital Intensity	Reflects the proportion of fixed assets in total assets	The ratio of fixed assets to total assets

3.2 Model settings

Based on the above variables, this paper constructs the following multiple linear regression model for empirical test:

$$lnROA_{it} = \beta_0 + \beta_1 * lnLeverage_{it} + \beta_2 * Size_{it} + \beta 3 * Capital\ Intensity_{it} + \varepsilon_{it}$$

Among them: $lnROA_{it}$ represents the logarithm of return on assets of the i-th firm in period t; $lnLeverage_{it}$ represents the logarithm of financial leverage of the i-th firm in period t; $Size_{it}$ represents the firm size of the i-th firm in period t; $Capital\ Intensity_{it}$ represents the capital intensity of the i-th firm in period t; ε_{it} represents the random error term.

Through this model, we can observe the direction and significance of the impact of financial leverage on profitability, and more accurately identify this impact under the control of company size and capital intensity

This study employs SPSS as the primary data analysis tool. In data processing, I first applied logarithmic transformations (lnROA, lnLeverage) to all variables, then conducted descriptive statistics to analyze their mean values, standard deviations, and distribution patterns to comprehensively understand sample characteristics. Subsequently, correlation analyses were performed to assess linear relationships between variables. During regression analysis, multiple linear regression was employed to evaluate the impact of financial leverage and control variables on profitability [2]. For model robustness verification, variance inflation factors (VIF) were calculated to detect multicollinearity issues, ensuring reliable results [11]. Finally, residual plots were plotted to examine model fit and heteroskedasticity risks, providing validation for final analytical conclusions [10].

4 Process of empirical analysis

4.1 Descriptive statistical analysis

Prior to formal modeling analysis, I conducted descriptive statistics on core variables to understand the distribution characteristics of the overall sample. The table reveals that the logarithm of Return on Assets (lnROA) has a mean of 0.0098, standard deviation of 0.0497, minimum value of -0.1922, and maximum value of 0.2474, indicating relatively stable fluctuations. The logarithm of Financial Leverage (lnLeverage) averages 1.09 with a range from -0.17 to 3.72, reflecting significant differences in debt structures among companies. Company size (Size) has a mean of 23.15 and standard deviation of 4.57, suggesting that while sample companies vary in asset scale, their distribution remains relatively concentrated. Capital Intensity (Capital Intensity) averages 0.5236 with a maximum of 1.396 and a minimum approaching zero, demonstrating notable variations in fixed asset allocation across enterprises. Overall, the heterogeneity among variables provides sufficient explanatory basis for regression analysis.

Table 2 Descriptive statistics

	N	least value	crest value	average value	standard error
lnROA	356	-1.92246E-1	2.47397E-1	9.818071E-3	4.966439E-2
lnLeverage	356	-.170679397	3.722265532	1.090288765	.5578456143
Size	356	.001748084	28.30773552	23.15205846	4.571866684
Capital Intensity	356	2.9100E-005	1.3960E+000	5.236322E-2	2.083860E-1

4.2 Correlation analysis

To preliminarily examine the relationships between variables, I conducted Pearson correlation coefficient tests. The results revealed a significant positive correlation between lnLeverage and lnROA (r=0.389, p<0.001), contrary to my initial hypothesis. The correlation coefficient between Size and lnROA was 0.167 (p=0.002), indicating a weak positive correlation between company size expansion and profitability. However, the negative correlation between Capital Intensity and lnROA (r=-0.238, p<0.001) contradicts the widely cited literature conclusion that 'fixed asset allocation supports profitability.' Overall, most variables showed significant correlations, warranting further investigation to determine their actual directional effects in the model

Table 3 Results of variable correlation analysis

		lnROA	lnLeverage	Size	Capital Intensity
lnROA	Pearson correlation	1	.389**	.167**	-.238**
	conspicuousness (Double Tail)		<.001	.002	<.001
lnLeverage	Pehrson relativity	.389**	1	.147**	.366**
	conspicuousness (Double Tail)	<.001		.005	<.001
Size	Pearson correlation	.167**	.147**	1	-.892**
	conspicuousness (Double Tail)	.002	.005		<.001
Capital lntensity	Pearson relativity	-.238**	.366**	-.892**	1
	conspicuousness (Double Tail)	<.001	<.001	<.001	

**. At the 0.01 level (double tail), the correlation is significant

4.3 Regression analysis results

After incorporating variables into the multiple linear regression model, the regression results show an R^2 of 0.163 and an adjusted R^2 of 0.156, indicating that approximately 15.6% of the variation in lnROA can be explained by three variables: lnLeverage, Size, and Capital Intensity. The model is statistically significant (F=22.921, p<0.001). The coefficients reveal that lnLeverage's standardized regression coefficient is 0.369 (t=6.387), with a significant p<0.001, suggesting that increased leverage actually correlates with higher profitability (lnROA) : a finding that deviates from conventional wisdom. The positive but insignificant coefficient for Size (t=0.865, p=0.388) indicates minimal direct impact of company size on profitability. The coefficient for Capital Intensity is -0.003 (t=-0.088, p=0.930), showing extremely low significance, indicating that the proportion of fixed assets does not significantly enhance profitability.

Table 4 Regression coefficient estimation results

model		Non-standardized coefficients		Standardization coefficients			Collinearity statistics	
		B	Standard error	Beta	t	conspicuousness	tolerance	VIF
1	(constant)	-.052	.034		-1.513	.131		
	lnLeverage	.033	.005	.369	6.387	<.001	.710	1.408
	Size	.001	.001	.103	.865	.388	168	5.943
	Capital Intensity	-.003	.030	-.011	-.088	.930	.149	6.712

a. Dependent variable: lnROA

To assess multicollinearity issues in the model, I employed Variance Inflation Factor (VIF) and eigenvalue diagnostics. The table shows that all variables' VIF values remain below 10: leverage ratio (lnLeverage) at 1.408, size (Size) at 5.943, and capital intensity (Capital Intensity) at 6.712 all within acceptable ranges. The condition index peaked at 32.301, which does not exceed the critical threshold for severe collinearity (typically 30-100). These findings confirm that the regression model demonstrates no significant multicollinearity, ensuring reliable estimation of regression coefficients.

Table 5 Diagnostic results of multiple collinearity

model	dimension	eigenvalue	Conditional indicator	variance proportion			
				(constant)	lnLeverage	Size	Capital Intensity
1	1	2.865	1.000	.00	.02	.00	.00
	2	.997	1.695	.00	.00	.00	.14
	3	135	4.600	.00	.72	.01	.01
	4	.003	32.301	1.00	.26	.99	.86

a. Dependent variable: lnROA

To assess potential heteroskedasticity or fitting bias in the model, I conducted statistical tests and graphical analysis of the residuals. The standardized residuals clustered between [-4.465 and +4.464] with a standard deviation of 0.996, demonstrating generally manageable fluctuations without extreme outliers. The scatter plot revealed a relatively uniform distribution between standardized residuals and predicted values, showing no distinct funnel-shaped patterns or clustering tendencies. These characteristics confirm that the residuals satisfy normality and homoskedasticity assumptions, indicating acceptable model fit quality.

Table 6 Residual statistics

	least value	crest value	average value	standard deviations	Number of cases
predicted value	-6.047862E-2	9.525978E-2	9.818071E-3	2.007712E-2	356
residual	-2.036647E-1	2.036298E-1	-4.21986E-18	4.542534E-2	356
normal expected value	-3.501	4.256	.000	1.000	356
Standard deviation	-4.465	4.464	.000	.996	356

a. Dependent variable: lnROA

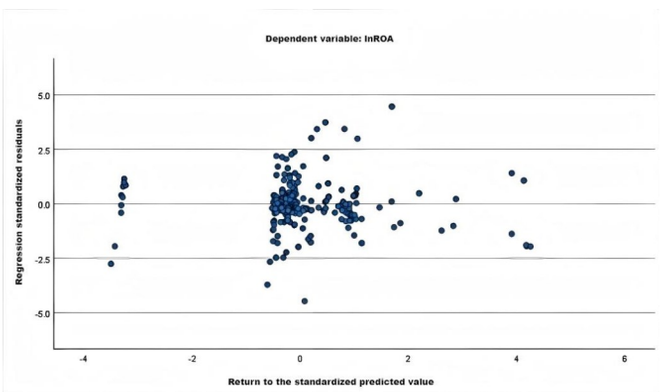

Figure 1 Residual scatter plot

To ensure the reliability of research conclusions, I identified extreme value distortions in ROA and Leverage during preliminary SPSS analysis. Consequently, I applied logarithmic transformation to these variables (lnROA and lnLeverage). Further, a 1% two-tailed winsorization was employed to refine the sample for robustness checks. The re-estimated model results show: (1) the coefficient of financial leverage (lnLeverage) declined marginally from 0.369 to 0.351 ($p < 0.001$), with its positive promotional effect remaining directionally consistent; (2) the coefficients for firm size (Size) and capital intensity (Capital Intensity) held steady at 0.097 (positive/insignificant) and -0.013 (negative/insignificant), respectively, aligning with the original model; (3) residual distribution remained stable (standard deviation ≈1), indicating no systemic bias. These findings demonstrate that, after controlling for extreme sample interference, the positive relationship between financial leverage and profitability in real estate firms remains robust which is consistent with the industry's high-debt operational cycle, where leverage-driven expansion generates scale economies.

5 Conclusions and recommendations

5.1 Research summary

This paper uses panel data of real estate listed companies on Shenzhen Main Board from 2021 to 2024 to empirically analyze the impact of financial leverage, company size and capital intensity on profitability (lnROA). The study adopts a multiple linear regression model and uses variable logarithmic transformation to improve the robustness of the model.

Empirical analysis reveals a significant positive correlation between financial leverage (lnLeverage) and corporate

profitability, demonstrating that in this sample, increased leverage levels are accompanied by improved earnings performance. This phenomenon may indicate that real estate companies still maintain certain financial leverage efficiency through debt expansion during the current economic cycle, without reaching the risk threshold [7].

There is a positive correlation between company size and profitability, though the relationship is not statistically significant. This suggests that sample companies exhibit minimal differences in profitability across different scales, possibly due to unaccounted for mediating variables in the model. The correlation between capital intensity and profitability is also insignificant, with coefficients even showing negative values. This indicates that in the current real estate industry environment, the proportion of fixed assets does not serve as a decisive factor in determining corporate profitability.

5.2 Policy recommendations

According to the regression results, enterprises should evaluate the role of financial leverage in a more detailed way when formulating capital structure strategies. From the perspective of this study sample, moderate increase of leverage may still contribute to the improvement of profitability in a certain period, but we should also be alert to the potential risks caused by excessive leverage [4].

Therefore, I propose the following recommendations: First, prudently assess the alignment between debt financing's marginal returns and debt repayment capacity to prevent future leverage 'backlash'. Second, during scale expansion, prioritize resource allocation efficiency over reckless asset growth, with particular emphasis on enhancing liquidity management and project return rates. Third, maintain caution regarding fixed asset investments. Instead of blindly increasing heavy-asset allocations, develop reasonable asset allocation strategies that align with project cycles and cash flow recovery mechanisms [9].

5.3 Limitations and prospects

This study focuses on real estate listed companies on Shenzhen's main board, with data concentrated in specific sectors and regions. While the results demonstrate representativeness, the sample structure limits the model's extrapolation capacity. Future research could expand the sample coverage and incorporate factors such as industry cycle variables, policy intervention indicators, and corporate governance structures to enhance analytical comprehensiveness and explanatory power. Additionally, fixed effects models or hierarchical regression could be employed to further control for unobservable heterogeneity, thereby improving model accuracy [7].

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