

Nonlinear Transmission of Debt Financing Risk to the Financial Performance of Housing Enterprises in China: The Moderating and Threshold Effects of the Household Leverage Ratio

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ABSTRACT

In the context of escalating debt pressure and heightened volatility in China's real estate market, the nonlinear transmission mechanism through which Debt Financing Risk affects the Financial Performance of Housing Enterprises remains insufficiently understood. Using panel data of 27 listed Chinese real estate firms from 2008 to 2024, this study constructs composite indices for Debt Financing Risk and Financial Performance and employs a two-way fixed effects model, panel threshold model to identify threshold effects and address potential endogeneity. The results reveal a significant inverted U-shaped relationship between Debt Financing Risk and Financial Performance, with a critical threshold of 69%. Below this level, moderate risk exposure enhances performance; beyond it, risk exerts a pronounced suppressing effect. Moreover, the Household Leverage Ratio exhibits both continuous and interval-based moderating effects. When household leverage remains below 77%, it reinforces the positive performance effect of debt risk; however, once it exceeds this threshold, it significantly amplifies the negative impact.

These findings highlight the existence of an optimal risk interval and underscore the macro-micro transmission role of credit structures in shaping nonlinear financing effects.

Keywords: debt financing risk, financial performance, household leverage ratio, nonlinear threshold effect

1. INTRODUCTION

1.1 Research background and problem statement

Against the backdrop of an increasingly complex economic and financial environment and the cyclical adjustment of China's real estate market, the prevention of systemic risk in the property sector has become a central priority of macro-financial regulation (IMF, 2023; Li & Zhang, 2024). For a prolonged period, China's real estate industry has been characterised by high leverage and strong dependence on external financing. Its debt

financing activities not only affect the financial robustness of individual firms but also generate spillover effects on macro-financial stability through multiple channels, including bank lending, bond markets, and household asset allocation (Gao et al., 2022; Wang et al., 2023). In recent years, amid tightening financing conditions and a rising incidence of corporate debt defaults, the transmission mechanism through which Debt Financing Risk influences the Financial Performance of Housing Enterprises has increasingly become a focal issue for both academia and policymakers.

From a long-term developmental perspective, the real estate sector has played a pivotal role in promoting economic growth, generating employment, and stimulating investment (Zhou & Liu, 2021). However, under the persistent “high-turnover and high-leverage” growth model, corporate debt levels have expanded substantially and financing structures have grown increasingly complex. When capital market conditions deteriorate or market expectations reverse, Debt Financing Risk may rapidly transmit to firm performance through balance-sheet channels, forming a negative feedback loop characterised by “financing pressure – cash flow contraction – operational deterioration.” Empirical evidence from international markets indicates that highly leveraged real estate firms exhibit pronounced financial vulnerability during periods of credit tightening (Miller & Zhang, 2024; Geltner & Fisher, 2025). Domestic studies similarly suggest that the expansion of debt scale plays a significant role in explaining performance volatility among Chinese housing enterprises (Wang, 2022; Zhang, 2023).

Although prior literature has made substantial progress in examining the relationship between debt financing and firm performance, most studies rely on linear regression frameworks and implicitly assume a monotonic effect of Debt Financing Risk on performance (Li & Ou, 2021; Amankwah et al., 2021). Such an assumption is not entirely consistent with the dual-effect mechanism embedded in Trade-off Theory, which emphasises the coexistence of tax shield benefits and financial distress costs. According to Trade-off Theory, debt financing may reduce the cost of capital at moderate levels of leverage but can simultaneously increase financial distress costs once leverage surpasses an optimal threshold (Kraus & Litzenberger, 1973; Strebulaev, 2020). Furthermore, Financial Accelerator Theory posits that under conditions of financing frictions, fluctuations in asset prices and credit conditions amplify risk shocks through the external finance premium mechanism (Bernanke & Gertler, 1989; Kiyotaki & Moore, 1997; Jordà et al., 2022). Taken together, these theoretical perspectives imply that the impact of Debt Financing Risk on the Financial Performance of Housing Enterprises is unlikely to be linear; rather, it may exhibit pronounced regime-dependent and threshold characteristics.

In addition, China’s real estate market operates within a distinctive institutional and macro-credit environment. On the one hand, since the implementation of regulatory measures such as the “Three Red Lines” policy in 2020, corporate leverage has been significantly constrained, leading to dynamic adjustments in financing costs and capital accessibility (People’s Bank of China, 2023; Li, 2025). On the other hand, the sustained

rise in the Household Leverage Ratio has reshaped housing demand structures and altered financial institutions' risk preferences, thereby influencing performance transmission channels from both the demand and financing sides (Mian & Sufi, 2011; Campbell & Cocco, 2007; Zhao & Liu, 2026). Existing studies typically treat these macro-level variables merely as control variables, with limited systematic identification and theoretical articulation of their potential moderating mechanisms.

In light of the above practical context and theoretical motivations, systematically examining the nonlinear transmission mechanism of Debt Financing Risk on the Financial Performance of Housing Enterprises in China, and investigating the moderating role of the Household Leverage Ratio, is of substantial importance for deepening the application of capital structure theory within highly leveraged industries.

1.2 Research design and marginal contributions

To address the aforementioned research questions, this study employs a panel dataset of Chinese listed housing enterprises spanning the period 2008–2024. A composite index of Debt Financing Risk and a multidimensional indicator of Financial Performance of Housing Enterprises are constructed to capture risk exposure and performance outcomes more comprehensively. Building upon a two-way fixed effects framework, this study further incorporates a panel threshold model to identify potential nonlinear interval effects of Debt Financing Risk. In addition, the moderating mechanism of the Household Leverage Ratio is systematically examined to assess how macro-level credit conditions reshape firm-level risk transmission dynamics.

Compared with the existing literature, the marginal contributions of this study are threefold.

First, this study moves beyond the conventional linear analytical framework by empirically identifying threshold effects and regime-dependent characteristics in the relationship between Debt Financing Risk and the Financial Performance of Housing Enterprises. By doing so, it extends the application of nonlinear capital structure theory to highly leveraged industries, offering new empirical evidence from China's real estate sector.

Second, this study constructs multidimensional composite indices for both Financial Performance of Housing Enterprises and Debt Financing Risk, thereby enhancing the systematic measurement and explanatory power of key variables. This approach mitigates the limitations of relying on single indicators to proxy for firm performance or financial risk, and provides a more robust representation of firms' financial conditions.

Third, the Household Leverage Ratio is introduced as a critical macro-level moderating variable. By doing so, this study uncovers a transmission pathway characterised by "household credit expansion – intensified financing frictions – amplified firm

performance volatility.” This contribution deepens the understanding of the interaction mechanism between the macro credit environment and corporate financing behaviour, and highlights the systemic linkages between household balance sheets and enterprise performance outcomes.

2.LITERATURE REVIEW

This section systematically reviews the theoretical foundations and empirical developments concerning the relationship between Debt Financing Risk and firm financial performance. On the basis of a critical assessment of the existing literature, the analytical framework of this study is subsequently developed.

2.1Debt financing risk and firm financial performance

Research on Debt Financing Risk has primarily focused on its formation mechanisms and its implications for corporate operational stability. Traditional capital structure theory posits that firms benefit from tax shield advantages through debt financing; however, as leverage increases, financial distress costs and agency costs rise concurrently, leading to the existence of an optimal capital structure range (Kraus & Litzenberger, 1973; Strebulaev, 2020).

More recent studies suggest that in highly leveraged and strongly cyclical industries, Debt Financing Risk exhibits pronounced dynamic accumulation characteristics. Dang et al. (2021) demonstrate that corporate debt risk tends to remain latent during economic expansion but becomes rapidly exposed during periods of credit contraction, thereby exerting amplified negative effects on firm performance. Boubaker et al. (2022) further indicate that within high-risk regimes, the adverse impact of financial leverage on firm profitability intensifies significantly.

Focusing specifically on the real estate sector, Miller and Zhang (2024), using a global sample of real estate firms, find that once leverage surpasses the industry median, corporate financial performance deteriorates markedly. Domestic evidence similarly confirms a significant association between debt expansion and performance volatility among housing enterprises (Liu, 2023; Zhang, 2024). Li and Wang (2025) further argue that during periods of tightening financing conditions, Debt Financing Risk erodes corporate financial stability through heightened cash flow pressure and refinancing constraints.

Despite these advances, the majority of existing studies rely on linear regression models that implicitly assume a unidirectional and monotonic relationship between debt risk and firm performance. Such an approach limits the ability to capture regime shifts and threshold characteristics that may arise during the process of risk accumulation.

With methodological advancements, scholars have increasingly examined the nonlinear relationship between debt financing and firm performance. Fischer et al. (1989), within a dynamic capital structure framework, argue that firms do not continuously adjust toward a single optimal leverage point but instead fluctuate within a target range. Strebulaev (2007) similarly proposes the existence of a “range-optimal” capital structure rather than a fixed optimum.

Recent empirical evidence further documents inverted U-shaped or threshold effects of debt on firm performance. Chen et al. (2023), using a sample of Asian firms, find that once leverage exceeds a critical level, its marginal negative effect expands sharply. Hassan et al. (2025) show that in the real estate industry, the inhibitory effect of Debt Financing Risk on profitability becomes significantly stronger in high-risk regimes.

Within the domestic context, Wang and Liu (2023) employ a panel threshold model and reveal significant interval effects of leverage among real estate firms. Specifically, when the asset–liability ratio exceeds 70%, its impact on ROA shifts from positive to negative. Nevertheless, existing studies largely focus on leverage ratios as single-dimensional indicators, while systematic measurement of the broader and more comprehensive concept of Debt Financing Risk remains relatively underdeveloped.

Accordingly, from both theoretical and methodological perspectives, there remains a need to integrate multidimensional risk indicators with nonlinear modelling techniques in order to more precisely identify the regime-dependent effects of Debt Financing Risk on corporate financial performance.

2.2 Macroeconomic credit environment and the moderating role of industry cycles

In recent years, the macro credit structure has been increasingly recognised as a crucial external determinant of corporate financing behaviour. Mian and Sufi (2011) demonstrate that the expansion of household leverage amplifies real estate cycle fluctuations. Jordà et al. (2022) further show that household debt expansion intensifies economic downturns when asset prices decline. Within the real estate context, Campbell and Cocco (2007) argue that rising household leverage alters the elasticity of housing demand. Mian et al. (2020) additionally suggest that a high Household Leverage Ratio increases the external finance premium and weakens corporate cash flow stability.

Evidence from the domestic context supports these findings. Zhao and Liu (2026) document that rising household leverage exacerbates financial risk among housing enterprises through demand contraction and credit constraint mechanisms. Chen et al. (2024) further indicate that household leverage expansion exhibits a pronounced amplification effect during turning points in real estate cycles.

Despite these insights, most existing studies treat the Household Leverage Ratio merely as a macro-level control variable, rather than systematically examining its moderating role in the relationship between Debt Financing Risk and corporate performance.

Consequently, the interaction mechanism between household balance sheet conditions and firm-level risk transmission remains insufficiently explored.

The real estate industry is inherently cyclical. Hendershott and MacGregor (2005) highlight that market prosperity directly influences firms' financing capacity and asset valuation. The IMF (2023) reports that fluctuations in property prices affect corporate financing risk through balance-sheet channels. Acharya et al. (2021) further find that during economic downturns, risk premia rise sharply, thereby intensifying corporate financing pressure. Wu and Zhao (2023) similarly document that declining Real Estate Market Prosperity significantly strengthens corporate default risk.

However, in the literature on housing enterprise performance, Real Estate Market Prosperity is frequently incorporated only as a control variable, with limited systematic investigation of its interaction effects with Debt Financing Risk. This omission restricts a comprehensive understanding of how macroeconomic cycles reshape the nonlinear transmission mechanism between financing risk and firm performance.

2.3 Literature assessment and research gaps

In summary, although the existing literature has provided important insights into the mechanisms through which Debt Financing Risk affects firm financial performance, and has increasingly acknowledged nonlinear characteristics and macro-credit factors, several limitations remain.

First, the prevailing empirical paradigm continues to rely predominantly on linear modelling frameworks, resulting in insufficient identification of interval effects and regime-dependent dynamics associated with Debt Financing Risk.

Second, most studies employ single leverage ratios or borrowing cost indicators as proxy variables, which constrains the comprehensive measurement of the multidimensional nature of Debt Financing Risk. Such simplifications may obscure the complex interactions between solvency pressure, refinancing constraints, and liquidity exposure embedded within corporate debt structures.

Third, macroeconomic variables such as the Household Leverage Ratio and Real Estate Market Prosperity are frequently incorporated merely as control variables, without systematic theoretical integration or empirical identification of their moderating roles. This limits a deeper understanding of how the macro credit environment interacts with firm-level financing risk to influence corporate performance outcomes.

To address these gaps, this study integrates Trade-off Theory and Financial Accelerator Theory at the theoretical level, thereby establishing a coherent analytical foundation for examining nonlinear and amplification mechanisms. Methodologically, a two-way fixed effects model is employed alongside a panel threshold model to identify regime-dependent interval effects of Debt Financing Risk. Furthermore, the moderating role of the Household Leverage Ratio is systematically examined, enabling the

construction of a comprehensive analytical framework linking Debt Financing Risk, the macro credit environment, and the Financial Performance of Housing Enterprises.

2.4 Theoretical analysis and research hypotheses

2.4.1 The impact of debt financing risk on the financial performance of housing enterprises: insights from trade-off theory and financial accelerator theory

Trade-off Theory posits that corporate debt financing embodies a dual nature characterised by tax shield benefits and financial distress costs. Firms dynamically balance these opposing forces to achieve an optimal capital structure (Kraus & Litzenberger, 1973; Dang et al., 2021). At relatively low levels of debt exposure, tax advantages and leverage-induced return amplification tend to dominate, thereby enhancing firm profitability. However, as Debt Financing Risk accumulates, financial distress costs and agency costs rise sharply, eventually eroding firm performance (Boubaker et al., 2022).

Financial Accelerator Theory further emphasises that in economies characterised by financing frictions, deterioration in firm balance sheets increases the external finance premium, thereby amplifying risk shocks (Bernanke & Gertler, 1990; Bernanke et al., 1999). In the real estate industry—a sector marked by high leverage and strong cyclicity—Debt Financing Risk is particularly susceptible to amplification through fluctuations in asset prices and cash flows (IMF, 2023; Acharya et al., 2021).

When Debt Financing Risk remains within a relatively manageable range, the tax shield effect reduces the overall cost of capital and improves net profitability (Frank & Goyal, 2009). Moderate risk-taking may enhance resource allocation efficiency and accelerate capital turnover (Li & Su, 2020). During periods of Real Estate Market Prosperity, debt financing facilitates faster project development and capital circulation, generating scale expansion effects (Chen et al., 2023). Recent evidence suggests that within a reasonable leverage range, debt expansion among housing enterprises is positively associated with profitability (Zhang et al., 2024).

However, once Debt Financing Risk surpasses a critical threshold, interest burdens and refinancing pressure escalate significantly, leading to rising financial distress costs (Dang et al., 2021). Asset price volatility reduces collateral value and increases the external finance premium (Bernanke et al., 1999). Intensified financing constraints subsequently trigger investment contraction and cash flow deterioration (Huang & Liu, 2022). In the context of volatility in China's real estate market, highly leveraged firms are more vulnerable to liquidity distress and substantial performance decline (Wu & Zhao, 2023). This process is highly consistent with the “asset price – external finance premium – risk amplification” mechanism described by Financial Accelerator Theory.

Taken together, these theoretical arguments suggest that the effect of Debt Financing Risk on the Financial Performance of Housing Enterprises is unlikely to be linear. Instead, it may exhibit significant threshold characteristics, whereby moderate levels of risk promote performance, while excessive risk generates disproportionately negative effects.

Hypothesis 1 (H1):

Debt Financing Risk exerts a significant nonlinear threshold effect on the Financial Performance of Housing Enterprises in China. Below the critical threshold, moderate debt risk enhances firm performance; beyond the threshold, its negative impact becomes significantly stronger.

2.4.2 The moderating role of the household leverage ratio: a macro-financial vulnerability transmission mechanism

The Household Leverage Ratio reflects the degree of credit expansion within the household sector and serves as a critical indicator of macro-financial vulnerability (Mian et al., 2020). In the real estate market, households function not only as the primary source of housing demand but also as a fundamental determinant of firms' operating cash inflows. Changes in household balance sheets influence the transmission intensity of corporate Debt Financing Risk through both demand-side and financial-side channels (Jordà et al., 2022).

When the Household Leverage Ratio remains within a sustainable range, household income growth and debt obligations are broadly aligned. Under such conditions, housing demand is released in a relatively stable manner, and firms benefit from predictable sales cash inflows (Zhao et al., 2023). A stable cash flow environment enhances firms' capacity to absorb debt-related shocks and reduces default probability. Meanwhile, financial institutions' risk expectations remain contained, preventing a significant rise in the external finance premium. In this setting, the adverse impact of Debt Financing Risk on the Financial Performance of Housing Enterprises may be partially mitigated through stable sales recovery mechanisms.

However, when the Household Leverage Ratio persistently increases beyond income fundamentals, household debt-servicing pressure intensifies and new housing demand weakens. Slower property sales reduce corporate cash inflows and heighten liquidity pressure. If market expectations reverse and asset prices decline, household net worth deteriorates, leading to an elevated risk of default. According to Financial Accelerator Theory, rising default risk among highly leveraged households prompts financial institutions to increase risk premia, thereby indirectly strengthening financing frictions faced by housing enterprises (Acharya et al., 2021).

Moreover, distress within the household sector may transmit to corporate financing conditions through adjustments in banks' balance sheets, potentially triggering systemic

credit contraction (Zhou et al., 2023). Under such high-leverage macro conditions, the negative impact of Debt Financing Risk on corporate financial performance is likely to be significantly amplified.

Hypothesis 2 (H2):

The Household Leverage Ratio significantly moderates the relationship between Debt Financing Risk and the Financial Performance of Housing Enterprises. Specifically, a higher Household Leverage Ratio strengthens the negative effect of Debt Financing Risk on firm financial performance.

3.MATERIAL AND METHODS

3.1 Data source and sample selection

This study employs an unbalanced panel dataset of Chinese listed housing enterprises covering the period 2008–2024. Firm-level financial data are obtained from the China Stock Market & Accounting Research (CSMAR) database and the Wind database. Macroeconomic indicators, including the Household Leverage Ratio, are sourced from the National Bureau of Statistics of China and the People's Bank of China.

To ensure data reliability and comparability, a multi-step screening procedure is implemented. First, firms designated as Special Treatment (ST) or *Special Treatment (*ST) during the sample period are excluded in order to avoid potential bias arising from extreme financial distress. Second, firms that were delisted or underwent substantial restructuring events are removed to maintain sample consistency and structural stability. Third, observations with substantial missing financial information are excluded to enhance data integrity.

After data cleaning, the final sample consists of 27 listed housing enterprises, yielding an unbalanced panel dataset. To mitigate the influence of outliers, all continuous variables are winsorised at the 1st and 99th percentiles.

3.2Variable definition and measurement

3.2.1Dependent variable

To comprehensively capture the Financial Performance of Housing Enterprises, this study constructs a multidimensional composite financial performance index as the dependent variable. Prior research commonly relies on single accounting-based indicators, such as Return on Equity (ROE) or net profit margin, to proxy firm performance. However, individual financial indicators are often sensitive to accounting policy adjustments and short-term fluctuations, and thus may fail to fully reflect the

capital-intensive nature, long development cycles, and delayed capital recovery characteristics of the real estate industry.

Accordingly, this study measures financial performance across three key dimensions: profitability, growth capacity, and operational efficiency. Four core indicators are selected:

Return on Equity (ROE) – measuring capital return efficiency; Net Profit Margin (NPM) – reflecting profitability level; Revenue Growth Rate (GROWTH) – capturing firm growth capacity;

Total Asset Turnover (TAT) – assessing asset utilisation efficiency.

To avoid potential bias arising from subjective weighting schemes, the entropy weighting method is employed to standardise the selected indicators and determine their respective weights. The entropy method assigns weights based on the degree of informational dispersion across indicators, thereby enhancing objectivity and robustness in index construction. The aggregated composite index is denoted as FP.

By integrating multiple dimensions of firm performance, the constructed index provides a more comprehensive and comparable measure of the Financial Performance of Housing Enterprises.

3.2.2 Core explanatory variable

Debt Financing Risk refers to the repayment pressure and funding mismatch risk that firms face in the process of structuring their financing arrangements and capital allocation. Unlike conventional studies that rely solely on leverage ratios or total debt scale as proxy measures of risk, this study constructs a multidimensional composite index of Debt Financing Risk to more accurately capture the financing vulnerability characteristics of housing enterprises.

Specifically, Debt Financing Risk is measured across four dimensions:

Capital Acquisition Capacity – reflecting the firm's ability to obtain financing resources;

Financing Pace and Capital Turnover – capturing the degree of alignment between financing rhythm and project development cycles;

Short-term Solvency Capacity – measuring liquidity pressure and short-term repayment risk;

Working Capital Matching – assessing the consistency between debt maturity structure and operational funding requirements.

All selected indicators are standardised prior to aggregation. The entropy weighting method is then applied to determine the objective weights of each dimension and construct the composite Debt Financing Risk index, denoted as DFR. A higher DFR value indicates a greater level of debt financing vulnerability.

By incorporating multiple dimensions of financing fragility, the constructed DFR index provides a more systematic and comprehensive measure of corporate debt-related risk exposure than single-indicator proxies.

Table 1: The Component Indicators of Debt Financing Risk and Financial Performance

Indicator	Sub-Dimensions	Calculation Formula	Regulatory Attribute
Financial Performance	Return on Equity (ROE)	Net Profit / Average Net Assets	+
	Net Profit Margin	Net Profit Margin = Net Profit/ Operating Revenue	+
	Revenue Growth Rate	Revenue Growth Rate = (Current Period Operating Revenue – Previous Period Operating Revenue) / Previous Period Operating Revenue	+
	Asset Turnover Ratio	Operating Revenue/ Average Total Assets	+
Debt Financing Risk	Fund Availability Capacity Dimension	Debt Financing Cash Inflows / Cash Outflows from Investing Activities	+
	Financing Rhythm and Capital Turnover Dimension	Annual Sales Revenue / Net Cash Inflows from Debt Financing Activities in the Current Year	-
	Short-Term Solvency Dimension	Current Ratio = Current Assets/ Current Liabilities	-
		Quick Ratio = Quick Assets /Current Liabilities	-
	Working Capital Matching Dimension	Receivables–Payables Matching Ratio = Accounts Receivable / Accounts Payable	+

3.2.3 Moderating variable

The Household Leverage Ratio reflects the debt burden borne by the household sector and represents a key macroeconomic variable influencing housing demand and the stability of firms' operating cash flows. To more accurately capture households' effective repayment pressure, this study measures the Household Leverage Ratio as the ratio of total household debt to disposable household income, defined as follows:

$$\text{Household Leverage Ratio} = \frac{\text{Household Deb}}{\text{Disposable Household Income}}$$

Compared with the conventional approach that uses GDP as the denominator, this income-based measure more precisely reflects households' actual debt-servicing constraints. It is therefore more consistent with the "balance-sheet constraint" mechanism emphasised in Financial Accelerator Theory, wherein repayment capacity relative to income determines the amplification of financial vulnerability.

3.2.4 Control variables

To mitigate omitted variable bias and alleviate potential endogeneity concerns, this study incorporates control variables at both the macroeconomic and firm-specific levels.

(1) Macroeconomic Control Variables

Macroeconomic control variables are introduced in lagged form (one-period lag) to reduce potential simultaneity bias arising from contemporaneous interactions among macroeconomic conditions and firm-level performance. The selected macro-level variables include:

Inflation – capturing price dynamics and overall macroeconomic stability;

GDP Growth – reflecting aggregate economic activity and demand conditions;

Income Growth – measuring changes in household income and purchasing power, which may influence housing demand and corporate cash flow conditions.

These variables collectively account for fluctuations in the broader macroeconomic environment that may affect both financing risk and firm performance.

(2) Firm-specific Control Variables

Firm-level controls are included to capture heterogeneity in firm size and internal financial conditions. Specifically, the model controls for:

Assets – serving as a proxy for firm size and scale effects;

Free Cash Flow – reflecting internal liquidity conditions and financial flexibility.

By incorporating both macroeconomic and firm-specific controls, the empirical specification more effectively isolates the independent effect of Debt Financing Risk on the Financial Performance of Housing Enterprises.

Table 2: Indicator Descriptions and Statistical Analysis

Variable Type	Variable		Mean	Std. Dev.	Min	Max
Dependent Variable	Financial Performance	459	0.512	0.184	0.103	0.892
Independent Variables	Debt Financing Risk	459	0.476	0.201	0.087	0.913
Moderating Variables	Household Leverage Ratio	17	0.587	0.129	0.321	0.846
Control Variables	Inflation Rate	17	2.17%	2.83	-0.7%	5.9%
	Economic Growth Rate	17	7%	5.21	2.2%	10.1%
	Income Growth Rate	17	7.31%	5.78	2.1%	10.6%
	Total Assets	459	668059	157316	1362962	144834
	Free Cash Flow	459	-859	3826547	-3010	2420

3.3 Model specification

3.3.1 Specification of the regression model

Based on the results of the aforementioned Hausman tests, both the Debt Financing Risk model and the Debt Financing Cost model are found to be more appropriately estimated using a fixed effects specification. Accordingly, to examine the nonlinear effects of Debt

Financing Risk on the Financial Performance of Housing Enterprises, this study constructs the following fixed effects model:

$$FP_{it} = \alpha_{it} + \alpha_1 DFR_{it} + \alpha_2 \sum MaControl_{it-1} + \alpha_3 \sum InControl_{it} + \mu_{it} + \lambda_{it} + \varepsilon_{it} \quad (1)$$

In the model specification, the dependent variable FP_{it} represents the Financial Performance. The core explanatory variable DFR_{it} denotes either Debt Financing Risk.

$MaControl_{it-1}$ refers to the lagged macro-level control variables, including the inflation rate, economic growth rate, and income growth rate. $InControl_{it}$ represents firm-level control variables, specifically total assets and free cash flow.

Time fixed effects are incorporated to control for common macroeconomic shocks across periods, while individual fixed effects are included to capture unobserved heterogeneity across Housing Enterprises.

3.3.2 Moderating effect model

According to the preceding literature review and theoretical analysis, Household Leverage Ratio is expected to exert strong moderating effects on the relationship between Debt Financing Risk and the Financial Performance of Housing Enterprises. To verify whether such moderating effects exist, this study extends Model (1) by constructing moderation effect models (2) and (3).

$$FP_{it} = \rho_{it} + \rho_1 DF_{it} + \rho_2 \sum MaContraI_{it} + \rho_3 \sum InContraI_{it} + \rho_4 HL_{it} + \varepsilon_{it} \quad (2)$$

$$FP_{it} = \alpha_{it} + \alpha_1 DF_{it} + \alpha_2 \sum MaContraI_{it} + \alpha_3 \sum InContraI_{it} + \alpha_4 HL + \alpha_5 DF_{it} * HL_{it} + \varepsilon_{it} \quad (3)$$

In Model (2), the statistical significance of coefficient ρ_4 serves as the basis for establishing the presence of a moderating effect. In Model (3), the coefficient of the interaction term tests the moderating effect of the Household Leverage Ratio on Financial Performance.

When the sign of coefficient α_5 is consistent with that of coefficient α_1 , it indicates a positive moderating effect; that is, the greater the moderating effect, the stronger the impact of Debt Financing Risk on Financial Performance under otherwise identical conditions. If the signs are opposite, this indicates a negative moderating effect; in this case, the stronger the moderating effect, the weaker the impact of Debt Financing Risk on Financial Performance, holding other factors constant. If coefficient α_5 is not statistically significant, the moderating effect does not exist.

3.3.3 Threshold model

The threshold regression model is a nonlinear econometric model originally proposed by Hansen (1999). The fundamental idea of the threshold regression model is regarded as an extension of grouped testing. Specifically, let φ denote the threshold variable. It is assumed that there exists a threshold value r such that when $\varphi > r$ or $\varphi \leq r$, the impact of the threshold variable φ on the dependent variable differs significantly.

There may be multiple threshold values associated with the threshold variable. When the threshold variable exceeds the specified threshold value, the model undergoes a structural break. According to the threshold value, cross-sectional units can be divided into different intervals. Examining the relationship between the independent and dependent variables within each interval allows for a more accurate identification of the relationship among variables.

Compared with traditional panel cointegration models, the panel threshold model has the following advantages. First, both the threshold value and the number of thresholds are endogenously determined by the sample data, and the sample is partitioned endogenously based on the threshold variable during estimation. Second, the confidence intervals of the estimated parameters and the statistical significance of the threshold value are determined based on asymptotic distribution theory and the bootstrap method. Finally, the estimation results of the model allow for an assessment of whether a structural break occurs in the relationship between the independent and dependent variables.

The threshold regression model can be expressed as follows:

$$y_i = x_i^l + e_i, q_i \leq r \quad (4)$$

$$y_i = x_i^l + e_i, q_i > r \quad (5)$$

Where y_i denotes the dependent variable, x_i^l represents a $p+1$ -order vector of explanatory variables, and q_i may or may not be a component of x_i^l . The role of the threshold variable q_i is to divide the sample into different groups (endogenous grouping). Following Hansen (2000), the threshold regression method identifies the turning point at which the regime changes according to the threshold variable. Different regimes in the model are characterised by whether the threshold variable is greater than or less than a given threshold value.

The model implies that when $q_i \leq r$ holds, the regression corresponds to Equation (4); when $q_i > r$ holds, the regression corresponds to Equation (5). A dummy variable D_{it} is defined to satisfy the following condition:

$$D_{it} = 1, q_i \leq r$$

$$D_{it} = 0, q_i > r$$

Accordingly, based on Models (2) and (3), the threshold regression model can be written as follows:

$$FPZ_{it} = C_i + \alpha DFR_{it}(q_i \leq r) + \beta_i^* DFR_{it}(q_i > r) + \delta_{it} Control_{it} + \varepsilon_{it} \quad (6)$$

Where $\varepsilon_{it} = (v_{it}, v_{it}^*)$ denotes the random disturbance error term. Equation (6) can be regarded as a piecewise functional model for changes in Financial Performance. When $q_i \leq r$ holds, the coefficient of Debt Financing Risk is α ; when $q_i > r$ holds,

the coefficient of Debt Financing Risk is β_i^* . Therefore, the selection of the threshold value E will affect the regression results of this piecewise functional model.

4.RESULTS AND DISCUSSION

4.1Fixed effects test

Table 3 Estimation Results of Different Fixed Effects Models

Dependent Variable: FP	Two-way Fixed Effects	Time Fixed Effects	Individual Fixed Effects
	Two-way FE (1)	Time FE (2)	FE (3)
DFR	-0.137*** (0.101)	-0.137*** (0.101)	-0.059 (0.112)
L_c_INCOME	0.272 (0.599)	0.272 (0.599)	0.001 (0.062)
L_c_CPIG	-1.388 (2.436)	-1.388 (2.436)	-0.316 (0.309)
L_c_GDPG	2.247 (1.832)	2.247 (1.832)	-0.083 (0.422)
CASH	0.008*** (0.002)	0.008*** (0.002)	0.013*** (0.002)
SIZE	-0.030** (0.013)	-0.030** (0.013)	-0.037*** (0.014)
Individual Effects	YES	NO	YES
Time Effects	YES	YES	NO
Observations	479	479	479
adj. R^2	0.572	0.572	0.419

Note: L denotes a one-period lag. Standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

The primary focus of this study is to examine the nonlinear relationship between Debt Financing Risk and the Financial Performance of Housing Enterprises under a mechanism-based framework using a panel threshold model. As the panel smooth transition model can be regarded as a derivative form of the panel fixed effects model, this study first estimates the relationship between the two variables using a conventional fixed effects model.

Table 3 reports the estimation results of several commonly used fixed effects models. Columns (1)–(3) present the estimated coefficients of Debt Financing Risk (DFR) on

Financial Performance. From the estimation results, although the magnitude of the coefficients varies across different model specifications, the coefficients are predominantly negative and statistically significant, indicating that Debt Financing Risk is overall negatively associated with the Financial Performance of Housing Enterprises. Taking the time fixed effects model as an example, the coefficient of Debt Financing Risk is -0.137 and is significant at the 1% level, suggesting that a 1% increase in Debt Financing Risk leads to a 0.137% decrease in Financial Performance.

4.2 Moderating effect test

Table 4 Moderating Effect of the Household Leverage Ratio on DFR

Explanatory Variable	Moderating Variable (HL) (1)	Moderating Variable (HL) (2)
DFR	0.162*(0.104)	0.312*** (0.100)
L_c_HL	-0.060*** (0.010)	-0.069 (0.073)
L_c_DFR*L_c_HL		0.218*** (0.07)
L_c_CPIG	-0.211 (0.284)	5.308 (5.300)
L_c_GDPG	-2.150*** (0.511)	-6.725 (7.385)
c_INCOME	0.008*** (0.002)	0.007*** (0.002)
c_FCF	-1.922*** (0.157)	-1.260*** (0.191)
c_SIZE	-0.029** (0.013)	-0.062*** (0.016)
N	479	479
adj. R^2	0.510	0.591

Note: L denotes a one-period lag. Standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 4 reports the estimation results of the interaction test in which Debt Financing Risk serves as the explanatory variable and the Household Leverage Ratio functions as the moderating variable.

In Column (1), after incorporating the moderating variable (Household Leverage Ratio), the coefficient of Debt Financing Risk remains positive and statistically significant. Meanwhile, the coefficient of the moderating variable is negative and statistically significant, indicating that higher household leverage is independently associated with weaker firm financial performance.

In Column (2), after introducing the interaction term between Debt Financing Risk and the Household Leverage Ratio, the coefficient of the interaction term is significantly positive at 0.218. The coefficient of Debt Financing Risk increases from 0.162 to 0.312 in the presence of the interaction term.

This suggests that the marginal effect of Debt Financing Risk on the Financial Performance of Housing Enterprises varies with the level of household leverage.

Specifically, as the Household Leverage Ratio increases, the impact of Debt Financing Risk on firm financial performance becomes stronger in magnitude.

These findings indicate that the Household Leverage Ratio exerts a significant moderating effect on the relationship between Debt Financing Risk and the Financial Performance of Housing Enterprises. The direction and magnitude of the effect depend on macro-level household leverage conditions, thereby providing partial support for Hypothesis 2.

4.3 Panel threshold regression test

4.3.1 Threshold effect of debt financing risk

Table 5 Estimated Results of the PSTR Model

Variable	Model 1: Household Leverage Ratio as the Threshold Variable	Model 2: Debt Financing Risk as the Threshold Variable
Linear		
L_c_DFR	0.023	0.37***
L_c_DFC		
L_c_M1	0.081	0.072
L_c_CPIG	-0.427	-0.147
L_c_GDPG	-2.5172392***	1.191
c_SIZE	-.06083714***	0.05707151**
c_LVD	-0.001	0.008
c_ROE	-1.1228981***	-2.5752304***
_cons	0.01145082***	0.01195055***
Nonlinear		
L_c_DFR	-0.04627**	-0.533***
L_c_M1	-0.035	-0.075
L_c_CPIG	1.050	-1.597
L_c_GDPG	3.3316847***	-1.319
c_SIZE	0.017	0.03
c_LVD	.02271539***	-0.003
c_ROE	-.89132087***	2.3259416***
threshold1	0.77***	0.69***

Note: L denotes a one-period lag. Standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 5 reports the estimation results when Debt Financing Risk (DFR) is employed as the threshold variable. The results indicate that the coefficient of the linear term is 0.37 (significant at the 1% level), while the coefficient of the nonlinear term is -0.533 (also significant at the 1% level). The estimated threshold value is 0.69.

These findings suggest that when Debt Financing Risk remains below 69%, a moderate increase in risk contributes positively to corporate financial performance. At this stage, debt expansion generates positive incentives through leverage amplification effects, capital structure optimisation, and improved resource allocation efficiency. However, once Debt Financing Risk exceeds 69%, its marginal effect turns significantly negative. Excessive risk levels intensify financing constraints, increase refinancing pressure, and substantially raise financial distress costs, thereby eroding corporate profitability.

4.3.2 Moderating effect of the household leverage ratio

When the Household Leverage Ratio (HL) is employed as the threshold variable, the estimation results show that the coefficient of the linear term is positive (0.023), while the coefficient of the nonlinear term is -0.046 (significant at the 5% level). The estimated threshold value is 0.77.

This indicates that the Household Leverage Ratio exerts a significant interval moderating effect on the relationship between Debt Financing Risk and financial performance. When the Household Leverage Ratio is below 77%, the impact of Debt Financing Risk on firm performance is relatively moderate, and an appropriate level of risk may be partially offset through demand release and improved sales cash recovery. However, once the Household Leverage Ratio exceeds 77%, household debt-servicing pressure rises markedly, housing demand elasticity declines, and the stability of sales cash inflows and corporate cash flows is adversely affected. As a result, the negative transmission effect of Debt Financing Risk on financial performance is significantly amplified.

4.3 Discussions

4.3.1 Threshold effect of debt financing risk

Table 5 reports the estimation results when Debt Financing Risk (DFR) is employed as the threshold variable. The results indicate that the coefficient of the linear term is 0.37 (significant at the 1% level), while the coefficient of the nonlinear term is -0.533 (also significant at the 1% level). The estimated threshold value is 0.69.

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4.3.2 Moderating effect of the household leverage ratio

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However, once the Household Leverage Ratio exceeds 77%, household debt-servicing pressure rises markedly, housing demand elasticity declines, and the stability of sales cash inflows and corporate cash flows is adversely affected. As a result, the negative transmission effect of Debt Financing Risk on financial performance is significantly amplified.

Accordingly, the empirical results support Hypothesis 2 (H2): the Household Leverage Ratio not only exerts a moderating effect, but this moderating mechanism also exhibits pronounced state-dependent characteristics.

5. Conclusion

This study conducts an empirical analysis centred on the “nonlinear transmission mechanism of Debt Financing Risk on the Financial Performance of Housing Enterprises in China” and systematically examines the moderating role of the Household Leverage Ratio. Using panel data of Chinese listed real estate firms over the period 2008–2024, this study constructs composite indices for Debt Financing Risk and Financial Performance, and applies a panel threshold model to identify nonlinear effects. The main findings are summarised as follows.

5.1 Hypothesis h1: nonlinear threshold effect of debt financing risk

Hypothesis 1 (H1) proposes that Debt Financing Risk exerts a significant nonlinear threshold effect on Financial Performance.

The empirical results indicate a pronounced inverted U-shaped relationship between Debt Financing Risk and the Financial Performance of Housing Enterprises, with an estimated threshold level of approximately 69%. Below this threshold, moderate risk-taking enhances firm performance through leverage amplification and resource allocation optimisation mechanisms. However, once the risk level exceeds the critical value, financial distress costs increase sharply, financing constraints intensify, and corporate performance declines significantly.

This finding is highly consistent with the core proposition of dynamic Trade-off Theory. Dang et al. (2021) argue that the optimal capital structure is not monotonic but characterised by a nonlinear optimal range. Boubaker et al. (2022) similarly demonstrate that within high-risk regimes, the negative impact of financial leverage on firm performance becomes substantially stronger. Li and Su (2020) further confirm that

excessive financing risk significantly undermines investment efficiency and compresses profitability.

Accordingly, the conclusions of this study are consistent with the existing empirical literature on the existence of an “optimal leverage range,” while providing new supporting evidence within the high-leverage context of the real estate industry.

5.2 Hypothesis h2: interval moderating effect of the household leverage ratio

Hypothesis 2 (H2) posits that the Household Leverage Ratio exerts a significant moderating effect on the relationship between Debt Financing Risk and Financial Performance.

The empirical results indicate that when the Household Leverage Ratio remains below 77%, the negative impact of Debt Financing Risk on Financial Performance is relatively moderate. However, once the Household Leverage Ratio exceeds 77%, the transmission of risk accelerates significantly, and the adverse effect becomes substantially amplified.

These findings suggest that macro-level household credit conditions reshape the marginal economic consequences of corporate debt risk through demand constraints, cash flow stability, and risk premium channels. This mechanism is highly consistent with Financial Accelerator Theory. Bernanke et al. (1999) argue that in the presence of financing frictions, asset price fluctuations and credit expansion amplify economic volatility. Jordà, Schularick, and Taylor (2022) show that household debt expansion significantly increases corporate risk exposure during economic downturns. Mian, Sufi, and Verner (2020) further demonstrate that firm-level cash flow volatility intensifies in high household leverage environments.

In the real estate sector, Zhang et al. (2021) and Wu et al. (2024) similarly find that rising household leverage exacerbates financial risk among housing enterprises through demand contraction and asset price adjustment channels. Therefore, the evidence presented in this study regarding the interval moderating effect of the Household Leverage Ratio is highly consistent with the existing macro-credit risk literature.

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