

Article

Nonlinear Impacts of Multidimensional Corporate Social Responsibility on Housing Affordability: Evidence from China's Listed Real Estate Companies via System GMM

Yidan Wang ^{1,*} and Tajul Ariffin Masron ² ¹ College of Science, North China University of Science and Technology, Tangshan 063210, China² School of Management, Universiti Sains Malaysia, George Town 11800, Penang, Malaysia

* Correspondence: wangyd@ncst.edu.cn

Abstract

Housing affordability is a critical socioeconomic challenge in China, but how different corporate social responsibility (CSR) dimensions shape it, and whether threshold effects exist, remain underexplored. This study examines linear and nonlinear impacts of five disaggregated CSR dimensions (environmental, social, economic, stakeholder, and voluntary) on housing affordability (measured by the housing affordability index, HAI, and the rental affordability index, RIA) using dynamic panel data from 87 Chinese listed real estate firms (2018–2023) via the system generalized method of moments (System-GMM). The results revealed heterogeneous threshold effects: (1) environmental and social CSR dimensions exhibit U-shaped relationships with the HAI/RIA; (2) economic, stakeholder, and voluntary CSR dimensions follow inverted-U patterns; (3) stakeholder CSR positively affects the RIA but not the HAI. Ownership heterogeneity emerges: state-owned enterprises (SOEs) leverage social and environmental CSR more effectively, while private enterprises' (POEs') economic CSR delivers stronger affordability dividends. This study fills the gap in nonlinear CSR affordability research and provides empirical basis for targeted strategies.

Keywords: corporate social responsibility (CSR); housing affordability; threshold effect; listed real estate firms; ownership heterogeneity; China



Academic Editor: Pierfrancesco De Paola

Received: 17 December 2025

Revised: 27 January 2026

Accepted: 30 January 2026

Published: 15 February 2026

Correction Statement: This article has been republished with a minor change. The change does not affect the scientific content of the article and further details are available within the backmatter of the website version of this article.

Copyright: © 2026 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the [Creative Commons Attribution \(CC BY\)](https://creativecommons.org/licenses/by/4.0/) license.

1. Introduction

1.1. Research Background

As a pillar industry of the national economy, the healthy development of China's real estate industry is directly related to people's livelihood and macroeconomic stability. In recent years, with the accelerated advancement of urbanization and continuous release of residents' housing demand, excessive rises in housing prices and rental levels have attracted widespread social attention. The issue of housing affordability has become a key bottleneck restricting the improvements in people's livelihood and the realization of common prosperity (Meng et al., 2023) [1]. Data from the National Bureau of Statistics shows that between 2018 and 2023, the average sales price of commercial housing in China rose from 8736 yuan per square meter to 10,185 yuan per square meter, while the average annual growth rate of urban residents' per capita disposable income during the same period was only 5.2%. The imbalance between housing price growth and income growth has further exacerbated housing affordability pressures.

Against this background, the government has successively introduced regulatory policies such as “housing is for living in, not for speculation” and “simultaneous development of rental and purchase housing” to promote the transformation of the real estate industry from scale expansion to high-quality development. Corporate social responsibility (CSR) [2], as a core issue of corporate sustainable development, has gradually become an important path to address the housing affordability dilemma. As the core subject of housing supply, real estate enterprises’ CSR practices are not only related to their own brand image and market competitiveness but also directly affect the quantity, quality, and price level of housing supply, thereby influencing housing affordability [3].

Different from developed markets, China’s real estate industry faces a unique institutional environment: on the one hand, the dual ownership structure of state-owned and private capital leads to significant differences in the CSR orientation of enterprises with different natures; on the other hand, external constraints such as strengthened environmental regulations and advanced affordable housing policies force enterprises to adjust their CSR resource allocation strategies. However, existing studies have mostly focused on the relationship between CSR and corporate financial performance (Dao et al., 2020; Hakimi et al., 2023) [4,5], with insufficient discussion on the mechanism by which CSR affects housing affordability. Moreover, existing research has three critical gaps: first, most adopt aggregated CSR indicators (e.g., ESG composite indexes) and ignore heterogeneous effects of subdivided dimensions (Dahlsrud, 2008; Dao et al., 2020) [4,6]; second, they assume linear relationships and fail to reveal threshold characteristics (Hakimi et al., 2023) [5]; third, few explore ownership heterogeneity in China’s dual institutional context. This study fills these gaps by decomposing CSR into five dimensions and testing nonlinear, ownership-heterogeneous effects on housing affordability [7].

Based on this, this paper takes Chinese A-share-listed real estate enterprises from 2018 to 2023 as the research sample, decomposes CSR into five dimensions (environmental, social, economic, stakeholder, voluntary), systematically examines its threshold effect on housing affordability, and explores the regulatory role of ownership type [8]. This study not only enriches the theoretical system of the relationship between CSR and people’s well-being but also provides an empirical basis for the government to formulate differentiated real estate regulatory policies and for enterprises to optimize CSR strategies [9].

1.2. Research Significance

1.2.1. Theoretical Significance

First, this study expands the application scenario of CSR research. Existing CSR studies mostly focus on micro-level issues such as corporate financial performance and innovation capacity. This paper extends the research perspective to the macro livelihood issue of housing affordability [10], constructs an analytical framework of “CSR dimensions—threshold effect—housing affordability”, and enriches the theoretical understanding of CSR’s impact on social welfare. A key theoretical contribution is clarifying housing affordability as a distinct, theoretically meaningful outcome variable that differs from traditional CSR outcomes (firm performance, environmental quality). Housing affordability is a critical societal welfare indicator directly reflecting the alignment between corporate behavior and residents’ basic needs, bridging micro corporate decisions and macro livelihood improvement. Unlike firm performance (a private good) or general social welfare (a broad concept), housing affordability is a targeted, measurable public good directly shaped by real estate enterprises’ supply behavior (e.g., housing quantity, quality, price). By focusing on this outcome, this study fills the gap in CSR research that “emphasizes private benefits over

public welfare” and advances the literature toward a more comprehensive understanding of CSR’s societal impacts beyond firm-level outcomes.

Second, it deepens the application of threshold effect theory in the field of CSR. Breaking through the limitation of linear assumptions, this paper empirically tests the threshold value and effect conversion mechanism of each CSR dimension on housing affordability, responds to the research call of Dao et al. (2020) [4] that “attention should be paid to the nonlinear effect of CSR”, and provides a new theoretical perspective for understanding the complexity of CSR’s role [11].

Third, it reveals the regulatory role of institutional context on CSR effects. Combining the dual ownership structure of state-owned and private enterprises in China’s real estate industry [6], this paper analyzes the differences in CSR practices of enterprises with different ownership types and their heterogeneous impacts on housing affordability, enriching the institutional embeddedness theory of CSR research in emerging markets.

1.2.2. Practical Significance

For the government, the CSR threshold value identified in this study can provide a quantitative basis for formulating differentiated real estate regulatory policies. By setting minimum CSR standards and implementing precise subsidies, it can guide enterprises to rationally allocate CSR resources and improve housing affordability. For real estate enterprises [12], the research results can clarify the optimal CSR strategies for enterprises of different ownership types: SOEs can focus on social dimension CSR to align with policy orientation, and POEs can strengthen economic dimension CSR to balance profitability and social responsibility, thereby achieving a win-win situation between corporate sustainable development and people’s livelihood improvement [13]. For society, this study helps to guide the public to pay attention to the practical value of CSR in the field of housing and promote the formation of a housing affordability improvement mechanism of “government guidance, enterprise leadership, and social supervision”.

1.3. Research Content and Technical Route

1.3.1. Research Content

Centering on the core research question: “How do multidimensional CSR practices affect housing affordability in China’s real estate industry, and do threshold effects and ownership heterogeneity moderate this relationship?” [14], this paper conducts the following research: ① Theoretical combing and research hypotheses: Based on stakeholder theory, threshold theory, etc., combined with the characteristics of China’s real estate industry, put forward research hypotheses that each dimension of CSR has a threshold effect on housing affordability; ② Research design: Select A-share-listed real estate enterprises from 2018 to 2023 as samples, construct housing affordability indicators (HAI, RIA), use the entropy weight method to measure five-dimensional CSR indicators, use the System-GMM method to test linear effects, and introduce quadratic terms to test threshold effects; ③ Heterogeneity analysis: Divide enterprises into SOEs and POEs based on ownership type, and compare and analyze the differences in the impact of each CSR dimension on housing affordability; ④ Robustness test and result discussion: Verify the reliability of results through methods such as lag term replacement and indicator replacement, and deeply interpret the economic significance and policy connotation of the results.

1.3.2. Technical Route

This paper follows the research idea of “literature combing—theoretical construction—empirical test—conclusion and implication”. The specific technical route is as follows: ① Comb relevant literatures on CSR, housing affordability, and threshold effect to clarify research gaps; ② Construct a theoretical framework of CSR’s impact on housing afford-

ability based on theoretical basis and industry characteristics, and put forward research hypotheses; ③ Select research samples, collect and sort out data, define and measure core variables and control variables; ④ Use Stata 17.0 software for empirical analysis, including descriptive statistics, correlation analysis, linear regression, threshold effect regression, and heterogeneity analysis; ⑤ Conduct robustness tests to verify the reliability of results; ⑥ Summarize research conclusions and put forward theoretical contributions, policy implications, and future research directions.

1.4. Research Innovations

The innovations of this paper are mainly reflected in three aspects: ① Innovation in research perspective: For the first time, CSR and housing affordability are incorporated into the same analytical framework, focusing on China's real estate industry (a key livelihood field), breaking through the limitation that existing studies mostly focus on the economic effects of CSR; ② Innovation in research methods: Adopt a deconstructed CSR measurement method, divide it into five dimensions for subdivided testing, and introduce quadratic term models and group regression to systematically examine threshold effects and ownership heterogeneity, improving the accuracy of research conclusions; ③ Innovation in research context: Combining China's "housing is for living in, not for speculation" policy background and the dual ownership structure of the real estate industry, reveal the regulatory role of institutional context on CSR effects, and provide localized empirical evidence for CSR research in emerging markets.

2. Literature Review and Theoretical Framework

2.1. Literature Review

2.1.1. Connotation and Influencing Factors of Housing Affordability

The core connotation of housing affordability is the matching degree between residents' housing expenditure and income level. Its measurement indicators mainly include ratio-type indicators, residual income-type indicators, and composite index-type indicators. Ratio-type indicators such as housing price-income ratio and rent-income ratio are widely used due to their simple calculation but fail to consider differences in family expenditure structure; residual income-type indicators evaluate affordability by calculating the remaining income after deducting housing expenditure, which is closer to the actual living standard of families; composite index-type indicators such as the HAI and the RIA comprehensively consider multiple factors such as income, housing price, rent, and interest rate, and the evaluation results are more comprehensive (Ghosh, 2016) [15].

Existing studies have shown that the influencing factors of housing affordability mainly include the macroeconomic level (GDP growth, interest rate level), industry level (market concentration, credit scale), and enterprise level (supply structure, pricing strategy) [16]. Among them, enterprise-level supply behavior is a direct factor affecting housing affordability. As an important orientation of enterprise behavior, the role of CSR in housing affordability has not been fully concerned.

2.1.2. Dimension Division and Economic-Social Effects of CSR

The division of CSR dimensions is the basis for studying its effects. Existing studies have two ideas: aggregated and deconstructed. The aggregated idea regards CSR as an overall construct and uses the ESG composite index to measure it but cannot reveal the heterogeneous effects of different dimensions (Dahlsrud, 2008) [6]; the deconstructed idea divides CSR into different subdivided dimensions, among which the five-dimensional division of environment, society, economy, stakeholder, and voluntary proposed by Dahlsrud (2008) [6] has been widely recognized [4].

The deconstructed idea divides CSR into subdivided dimensions, with Dahlsrud's (2008) [6] five-dimensional framework (environment, society, economy, stakeholder, voluntary) widely recognized for capturing heterogeneous mechanisms (Dao et al., 2020; Hakimi et al., 2023; Chandratreya, 2024) [4,5,17]. These dimensions are theoretically inter-related but functionally independent mechanisms: (1) Environmental and social CSR are primarily compliance-driven, reflecting enterprises' response to external regulatory and public welfare demands; (2) Economic and stakeholder CSR are operationally integrated, with economic CSR laying the foundation for resource allocation to stakeholder interests; (3) Voluntary CSR is a supplementary mechanism that enhances the depth of responsible behavior beyond compliance and operational needs. Parallel analysis of these dimensions is justified because each targets distinct stakeholders (e.g., environmental CSR for society at large, stakeholder CSR for tenants/employees) and operates through different channels (e.g., cost reduction vs. supply structure optimization) to affect housing affordability. While they constitute components of an integrated CSR system, their heterogeneous mechanisms require separate examination to identify targeted strategies.

In terms of the economic effects of CSR, existing studies have three views: "positive theory", "negative theory", and "uncertainty theory". The positive theory holds that CSR can enhance corporate performance by improving brand image and reducing financing costs [7,17]; the negative theory holds that CSR investment will increase corporate costs and damage financial performance in the short term (Gatti et al., 2019) [18]; the uncertainty theory holds that the relationship between CSR and corporate performance is regulated by factors such as institutional environment and industry characteristics (Dao et al., 2020) [4]. In terms of social effects, CSR research mostly focuses on areas such as environmental governance and employment promotion, and rarely involves the core livelihood issue of housing affordability [19]. Moreover, existing studies mostly assume a linear relationship, ignoring the possible threshold effect [20].

2.1.3. Research on the Relationship Between CSR and Housing Affordability

Existing CSR–housing affordability research is scarce and qualitative [18]. No studies have quantified nonlinear relationships or ownership differences, leaving unclear how specific CSR dimensions shape affordability in China's policy context [21]. Some studies believe that the social responsibility practices of real estate enterprises (such as the construction of affordable housing and the promotion of green buildings) can improve housing affordability by increasing housing supply and optimizing supply structure [22]; however, other studies point out that CSR investment such as green buildings will increase enterprise costs, which may lead to rising housing prices and thus reduce housing affordability (Gatti et al., 2019) [18].

The above studies have the following limitations: first, lack of quantitative analysis, failing to accurately reveal the quantitative relationship between CSR and housing affordability [23]; second, failing to divide CSR into dimensions, unable to identify the heterogeneous impact of different dimensions [24]; third, failing to consider the nonlinear characteristics and institutional context differences of CSR's impact on housing affordability [25]. Based on this, this paper puts forward the core research hypothesis that "each dimension of CSR has a threshold effect on housing affordability, and this effect is regulated by ownership nature", making up for the gaps in existing research.

2.2. Theoretical Framework and Research Hypotheses

2.2.1. Analysis Based on Stakeholder Theory

Stakeholder theory holds that the survival and development of an enterprise depend on the support of various stakeholders, and the enterprise should balance the needs of

different stakeholders by fulfilling social responsibilities (Freeman, 1984) [25]. For real estate enterprises [26], their stakeholders include the government, residents, employees, suppliers, etc. Among them, residents, as housing demanders, view regard affordable housing as an important direction of corporate social responsibility [18].

From the perspective of each CSR dimension, the environmental dimension (CSR_ENV) involves practices such as green buildings and pollution control. Initial investment may increase construction costs [15], but in the long run, efficiency can be improved through energy conservation and policy subsidies. The social dimension (CSR_SOC) involves the construction of affordable housing and tax contributions, which directly increase housing supply, alleviate government financial pressure, and thus improve housing affordability [27]. The economic dimension (CSR_ECO) involves responsible economic behavior such as fair pricing and stable employment, which can reduce costs through standardized operations and thus reduce housing prices. The stakeholder dimension (CSR_STA) involves employee welfare and customer service, which can improve rental affordability by improving service quality and optimizing rental terms. The voluntary dimension (CSR_VOL) involves charitable donations and technological research and development, which can improve housing affordability by donating housing subsidies and developing low-cost construction technologies [28].

Each indicator is theoretically justified as a CSR component based on stakeholder theory and Dahlsrud's (2008) [6] five-dimensional framework.

For social CSR (CSR_SOC), the tax contribution rate reflects responsibility to the government (public finance support), the fixed asset turnover rate reflects responsible resource utilization (reducing waste to benefit society), and the number of litigation violations reflects legal compliance responsibility to stakeholders.

For economic CSR, the fair pricing rate reflects responsibility to homebuyers (avoiding price gouging), the supply chain payment compliance rate reflects responsibility to suppliers (ensuring their financial stability), and employment stability rate reflects responsibility to employees (providing job security) [29].

These indicators capture “responsible behavior” rather than mere performance, as they reflect the alignment of corporate operations with stakeholder interests beyond profit maximization.

2.2.2. Analysis Based on Threshold Theory

Threshold theory holds that the relationship between variables is not linear—when the explanatory variable reaches a critical threshold, its impact direction/intensity changes significantly (Hakimi et al., 2023; Naeem et al., 2025) [5,30]. From a microeconomic cost–benefit perspective, the threshold mechanism of CSR on housing affordability is rooted in the dynamic balance between marginal cost (MC) and marginal revenue (MR) of CSR investment [31], which explains why different CSR dimensions exhibit distinct nonlinear patterns.

For environmental CSR (CSR_ENV) and social CSR (CSR_SOC), these dimensions involve high fixed costs in initial investment (e.g., green material procurement, affordable housing land acquisition, policy compliance costs). In the early stage, $MC > MR$ because scale effects have not yet formed, and the additional costs of CSR exceed the incremental benefits (e.g., energy savings, policy subsidies), thus inhibiting housing affordability [32]. When CSR investment crosses the threshold, economies of scale (e.g., bulk purchasing of green materials, centralized construction of affordable housing) reduce marginal costs, while long-term benefits such as brand premium, policy support, and operational efficiency gains increase marginal revenue, making $MR > MC$, and thus promoting housing affordability—forming a U-shaped pattern.

For economic CSR (CSR_ECO), stakeholder CSR (CSR_STA), and voluntary CSR (CSR_VOL), moderate investment optimizes resource allocation (e.g., operational efficiency improvement, targeted tenant services, low-cost technology R&D), achieving $MC = MR$ and maximizing affordability gains. However, excessive investment leads to diminishing marginal returns: overemphasis on economic CSR may lead to cost-cutting at the expense of housing quality (reducing effective supply value), excessive stakeholder CSR (e.g., overly generous tenant subsidies) increases operational burden, and overinvestment in voluntary CSR (e.g., symbolic donations) diverts resources from core business—all resulting in $MR < MC$ and forming an inverted U-shaped pattern.

The quadratic term specification is chosen for three reasons. First, it is a standard and widely accepted method to test threshold effects in panel data research (Hakimi et al., 2023; Dao et al., 2020) [4,5], enabling clear calculation of threshold values and intuitive interpretation. Second, theoretical analysis suggests that the CSR–affordability relationship is characterized by a single threshold (cost–benefit break-even point), which is well captured by quadratic terms. Third, robustness tests (e.g., lagged CSR substitution, alternative affordability metrics) confirm the consistency of the nonlinear patterns. Nevertheless, this approach has limitations: quadratic terms assume a smooth transition between pre- and post-threshold effects, which may oversimplify more complex nonlinear dynamics (e.g., multiple thresholds). Alternative techniques such as Hansen’s threshold regression or nonparametric methods could be used for further verification. Future research may adopt these methods to explore multiple thresholds and non-smooth transitions.

2.2.3. Analysis of the Regulatory Effect Based on Ownership Heterogeneity

There is significant ownership heterogeneity in China’s real estate industry, and the CSR orientation of SOEs and POEs is essentially different. As an important executor of government policies, SOEs’ CSR practices are closer to policy orientation, such as the construction of affordable housing and the promotion of green buildings, so the effects of the social and environmental CSR dimensions may be more significant. POEs take profitability as the core goal, and their CSR practices pay more attention to economic benefits, such as improving operational efficiency and carrying out targeted donations, so the effects of economic and voluntary CSR dimensions may be more significant.

In addition, SOEs can reduce CSR investment costs through government subsidies and land preferences, and their CSR threshold value may be lower than that of POEs. POEs face higher financing costs and market competition pressure, and their cost sensitivity to CSR investment is higher, so the threshold effect may be more significant.

2.2.4. Research Hypotheses

Based on stakeholder theory (Freeman, 1984) [25] and threshold theory (Hakimi et al., 2023) [5], this paper puts forward the following streamlined research hypotheses:

H1 (U-shaped threshold effect for environmental/social CSR). *Guided by threshold theory, the environmental (CSR_ENV) and social (CSR_SOC) CSR dimensions involve high initial fixed costs (e.g., green materials, affordable housing land). Below the threshold, marginal cost > marginal revenue (inhibiting affordability); above the threshold, scale effects and policy dividends reverse this (promoting affordability) for both the HAI and the RIA.*

H2 (inverted U-shaped threshold effect for economic/stakeholder/voluntary CSR). *Drawing on stakeholder theory, moderate investment in the economic (CSR_ECO), stakeholder (CSR_STA), and voluntary (CSR_VOL) CSR dimensions optimizes resource allocation (maximizing affordability). Overinvestment leads to diminishing returns (marginal revenue < marginal cost) for the HAI and the RIA.*

H3 (ownership moderation). *Rooted in institutional theory, SOEs (policy-driven) have lower thresholds for environmental/social CSR, while POEs (market-driven) have more significant threshold effects for economic/voluntary CSR.*

H4 (dimension-specific effect). *Stakeholder CSR targets tenant interests (stakeholder theory), so its threshold effect is significant for the RIA (rental affordability) but not the HAI (purchase affordability).*

3. Research Design

3.1. Variable Definition and Measurement

3.1.1. Dependent Variable: Housing Affordability

This paper measures housing affordability from two dimensions: “purchase affordability” and “rental affordability”, using the housing affordability index (HAI) and the rental affordability index (RIA) as core dependent variables. Referring to the compilation method, the calculation formula of the HAI is: $HAI = (\text{provincial residents' per capita disposable income} \times 30\%) / (\text{provincial average commercial housing price} \times \text{provincial per capita housing area}) \times 100$. Here, 30% is the internationally accepted reasonable proportion threshold of housing expenditure, and provincial-level data are used to align with the regional concentration of real estate enterprises' housing supply. A higher HAI value indicates stronger housing purchase affordability.

The calculation formula of the RIA is: $RIA = (\text{provincial residents' per capita disposable income} \times 25\%) / (\text{provincial average housing rental price} \times \text{provincial per capita housing area}) \times 100$. Here, 25% is the reasonable proportion threshold of rental expenditure, and provincial-level data are also used. A higher RIA value indicates stronger rental affordability. The data are from the iFinD database and the National Bureau of Statistics.

Note: A potential limitation of the affordability measurement is the aggregation mismatch: HAI/RIA is calculated using provincial-level data (instead of national-level data) to address regional heterogeneity, while the explanatory variables are at the firm level. To mitigate this, we match each enterprise to its registered province and use provincial-level data for calculation, as enterprises' housing supply is mainly concentrated in their registered region. Additionally, we add regional control variables to further address spatial heterogeneity.

3.1.2. Core Explanatory Variable: Corporate Social Responsibility (CSR)

Referring to the five-dimensional division method of Dahlsrud (2008) [6] and considering the characteristics of China's real estate industry, CSR is divided into five dimensions: the environmental dimension (CSR_ENV), the social dimension (CSR_SOC), the economic dimension (CSR_ECO), the stakeholder dimension (CSR_STA), and the voluntary dimension (CSR_VOL). The entropy weight method is used to calculate the score of each dimension. The specific indicator selection and measurement are as follows:

- (1) The environmental dimension (CSR_ENV): Select Tonghuashun ESG environmental score as the core indicator. This indicator covers multiple dimensions, such as environmental management, climate change response, and waste disposal, comprehensively reflecting the level of corporate environmental responsibility performance. The data are from the iFinD database.
- (2) The social dimension (CSR_SOC): Select three indicators: tax contribution rate, fixed asset turnover rate, and number of litigation violations. Among them, tax contribution rate = tax payable/operating income, reflecting the enterprise's contribution to public finance; fixed asset turnover rate = operating income/average fixed assets, reflecting the efficiency of enterprise resource utilization; the number of litigation violations

reflects the level of enterprise legal compliance. After standardized processing, the social dimension score is synthesized by the entropy weight method. The data are from the iFinD database and enterprise annual reports.

- (3) The economic dimension (CSR_ECO): To avoid confusing “corporate social responsibility” with “financial performance”, we redefine economic CSR as “responsible economic behavior that balances corporate profitability, stakeholder interests, and social value”. We select three indicators: fair pricing rate (ratio of the enterprise’s average housing sales price to the regional average housing sales price, reflecting the responsibility of fair pricing to homebuyers), supply chain payment compliance rate (ratio of on-time payment to suppliers to total supplier payments, reflecting the responsibility to upstream stakeholders), and employment stability rate (ratio of employees with service tenure ≥ 3 years to total employees, reflecting responsibility to employees). The economic dimension score is synthesized by the entropy weight method. The data are from the iFinD database and enterprise annual reports. The original performance-heavy indicators (ROE, DAR, CR, ITR) are retained as a “financial performance proxy” for robustness testing to verify whether the core conclusions are affected by indicator selection.
- (4) Stakeholder dimension (CSR_STA): Select four indicators: earnings per share (EPS), average employee salary (ASE), sales expense rate (SER), and accounts payable turnover rate (APTR). EPS reflects the interests of investors, ASE reflects the interests of employees, SER reflects customer maintenance investment, and APTR reflects the efficiency of supplier payment. The stakeholder dimension score is synthesized by the entropy weight method. The data are from the iFinD database and enterprise annual reports [1].
- (5) Voluntary dimension (CSR_VOL): Select two indicators: external donation ratio and R&D expense rate. External donation ratio = total external donations/operating income, reflecting corporate charitable responsibility; R&D expense rate = R&D expenses/operating income, reflecting corporate innovation investment in low-cost construction, green technology, and other fields. The voluntary dimension score is synthesized by the entropy weight method. The data are from the iFinD database and enterprise annual reports.

3.1.3. Moderating Variable: Ownership Type (OT)

Enterprises are divided into state-owned enterprises and private enterprises. When the actual controller of the enterprise is the central government, local government, or state-owned asset management department, OT = 1 (state-owned enterprise); when the actual controller of the enterprise is a natural person or private enterprise, OT = 0 (private enterprise). The data are from the iFinD database.

3.1.4. Control Variables

Following existing studies, control variables at the enterprise level, industry level, macro level, and regional level are selected to exclude the interference of other factors on the empirical results:

- (1) Enterprise-level control variables: enterprise age (AGE), measured by the natural logarithm of “observation year – establishment year + 1”, reflecting enterprise operation experience; market capitalization rate (LNMC), measured by the natural logarithm of total market value, reflecting enterprise scale; ownership concentration (TOP1), measured by the shareholding ratio of the largest shareholder, reflecting the level of corporate governance; average excess turnover rate (AETR), measured by the average of monthly stock abnormal turnover rate, reflecting market attention.

- (2) Industry-macroeconomic composite factor (IMF): Considering the multicollinearity between industry-level and macro-level variables, five indicators, including industry concentration (HHI), business climate index (BCI), real estate loan balance (RELB), GDP growth rate, and 1-year loan market quoted rate (1-LPR), are selected to synthesize the industry-macroeconomic composite factor through principal component analysis (PCA), and the weight is the variance explanation rate of each principal component. The data are from the iFinD database and the National Bureau of Statistics.
- (3) Regional development level (REG): measured by the natural logarithm of provincial per capita GDP, reflecting differences in regional economic development, housing market supply–demand dynamics, and income levels. The data are from the National Bureau of Statistics.

The specific definition, measurement method, and data source of each variable are shown in Table 1.

Table 1. Variable definition, measurement and data source.

Variable Type	Variable Name	Core Connotation	Measurement Method	Data Source
Dependent Variable	Housing Affordability Index (HAI)	Degree of housing purchase affordability	(Residents per capita disposable income $\times$ 30%)/(Average commercial housing price $\times$ Per capita housing area) $\times$ 100	iFinD, National Bureau of Statistics
	Rental Affordability Index (RIA)	Degree of housing rental affordability	(Residents per capita disposable income $\times$ 25%)/(Average housing rental price $\times$ Per capita housing area) $\times$ 100	iFinD, National Bureau of Statistics
Core Explanatory Variable	Environmental CSR (CSR_ENV)	Level of corporate environmental responsibility performance	Tonghuashun ESG environmental score (standardized by entropy weight method)	iFinD
	Social CSR (CSR_SOC)	Level of corporate social contribution and compliance	Tax contribution rate + fixed asset turnover rate of litigation violations	iFinD, Enterprise Annual Reports
	Economic CSR (CSR_ECO)	Corporate profitability and operational efficiency	ROE + current ratio+ inventory turnover rate	iFinD
	Stakeholder CSR (CSR_STA)	Level of multi-stakeholder rights and interests protection	EPS + average employee salary + sales expense rate	iFinD, Enterprise Annual Reports
	Voluntary CSR (CSR_VOL)	Level of corporate charitable and innovative investment	External donation ratio + R&D expense rate	iFinD, Enterprise Annual Reports
Moderating Variable	Ownership type (OT)	Type of corporate ownership	1 = State-owned enterprise; 0 = Private enterprise	iFinD
Control Variable	Enterprise Age (AGE)	Length of enterprise operation history	$\ln(\text{Observation year} - \text{Establishment year} + 1)$	iFinD
	Market Capitalization Rate (LNMC)	Enterprise scale	$\ln(\text{Total market value of the enterprise})$	iFinD
	Ownership Concentration (TOP1)	Degree of major shareholder control	Shareholding ratio of the largest shareholder (%)	iFinD
	Average Excess Turnover Rate (AETR)	Enterprise market attention	Average of monthly stock abnormal turnover rate	iFinD
	Industry-Macroeconomic Factor (IMF)	Comprehensive status of industry and macroeconomy	HHI + BCI + RELB + GDP growth rate + 1 LPR	iFinD, National Bureau of Statistics

3.2. Model Setting

3.2.1. Linear Regression Model

To test the linear impact of each CSR dimension on housing affordability, following the specification of dynamic panel data models, the lagged first-order term of the dependent

variable is introduced to control the path dependence effect, and the benchmark linear regression model is constructed as follows:

$$HAI_{it} = \alpha_0 + \alpha_1 HAI_{i,t-1} + \alpha_2 CSR_{it} + \alpha_3 Controls_{it} + \mu_i + \varepsilon_{it} \quad (1)$$

$$RIA_{it} = \beta_0 + \beta_1 RIA_{i,t-1} + \beta_2 CSR_{it} + \beta_3 Controls_{it} + \mu_i + \varepsilon_{it} \quad (2)$$

Among them, HAI_{it} and RIA_{it} are the housing affordability index and the rental affordability index of enterprise i in year t , respectively; $HAI_{i,t-1}$ and $RIA_{i,t-1}$ are their lagged first-order terms; CSR_{it} is the core explanatory variable, substituting the five dimensions of CSR_ENV , CSR_SOC , CSR_ECO , CSR_STA , and CSR_VOL , respectively; $Controls_{it}$ is the vector of control variables, including AGE, LNMC, TOP1, AETR, IMF, and REG; μ_i is the enterprise fixed effect; ε_{it} is the random error term.

3.2.2. Threshold Effect Model

To test the threshold effect of each CSR dimension on housing affordability, the quadratic term of CSR (centralized processing to avoid multicollinearity) is introduced into the benchmark model, and the threshold effect regression model is constructed as follows:

$$HAI_{it} = \alpha_0 + \alpha_1 HAI_{i,t-1} + \alpha_2 CSR_{it}^C + \alpha_3 (CSR_{it}^C)^2 + \alpha_4 Controls_{it} + \mu_i + \varepsilon_{it} \quad (3)$$

$$RIA_{it} = \beta_0 + \beta_1 RIA_{i,t-1} + \beta_2 CSR_{it}^C + \beta_3 (CSR_{it}^C)^2 + \beta_4 Controls_{it} + \mu_i + \varepsilon_{it} \quad (4)$$

Among them, CSR_{it}^C is the centralized CSR indicator of each dimension, and $(CSR_{it}^C)^2$ is its quadratic term; if α_2 is significantly negative, and α_3 is significantly positive, this indicates a U-shaped threshold effect; if α_2 is significantly positive, and α_3 is significantly negative, this indicates an inverted U-shaped threshold effect. The threshold value is obtained by solving the extreme point of the quadratic function, that is, the threshold value = $-\alpha_2 / (2\alpha_3)$.

3.2.3. Heterogeneity Regression Model

To test the regulatory effect of ownership type, the sample is divided into state-owned enterprise groups and private enterprise groups and substituted into models (3) and (4) for separate group regressions. The differences in threshold values and coefficients between the two groups are compared.

Among them, the grouping variable is ownership type (OT). When $OT = 1$, the firm belongs to the state-owned enterprise group; when $OT = 0$, the firm belongs to the private enterprise group. By comparing α_2 , α_3 , and the threshold values between the two groups, the regulatory role of ownership type is verified.

3.3. Sample Selection and Data Source

3.3.1. Sample Selection

This paper selects Chinese A-share-listed real estate enterprises from 2018 to 2023 as the research sample. The sample screening followed the following principles: ① according to the 2012 Industry Classification Standard of the China Securities Regulatory Commission (CSRC), select listed companies in the “real estate industry” (code J01); ② exclude B-share-listed companies because the market environment of B-shares is quite different from that of A-shares, and the data comparability is low; ③ exclude companies that have been specially treated (ST, *ST, PT) and delisted. Such companies have abnormal financial conditions, which may affect the reliability of empirical results; ④ exclude companies with missing data on core variables (each dimension of CSR, HAI, RIA); ⑤ exclude companies listed after 2019, which lack complete sample period data. After the above screening, 87 listed companies were finally obtained, with a balanced panel data of 522 firm-year observations.

3.3.2. Data Source

The data sources of this paper mainly include: ① enterprise-level data (each dimension of CSR indicators, financial indicators, ownership type, etc.) are from the iFinD database and listed company annual reports; ② housing affordability data (average commercial housing price, average rental price, etc.) are from the iFinD database and the National Bureau of Statistics; ③ macroeconomic and regional data (GDP growth rate, 1-LPR, provincial per capita GDP, etc.) are from the National Bureau of Statistics and the People's Bank of China. To avoid the impact of outliers, all continuous variables are winsorized at the 1% quantile.

3.3.3. Sample Period Selection

The sample period from 2018 to 2023 is selected mainly based on the following two considerations: ① policy background: In December 2017, the China Securities Regulatory Commission revised the Guidelines for Corporate Governance of Listed Companies, clearly requiring key pollutant-discharging units to disclose environmental information. Since 2018, the standardization of CSR disclosure of listed companies has been significantly improved, and the data availability and reliability have been enhanced. ② Methodological requirements: In the dynamic panel data model, an excessively long time dimension (T) may lead to the invalidity of instrumental variables. A 6-year sample period ($T = 6$) can not only ensure the number of observations but also avoid the problem of weak instrumental variables.

3.4. Estimation Method and Diagnostic Test

3.4.1. Selection of Estimation Method

This paper adopts the System-GMM method for three key reasons: ① dynamic panel data (with lagged dependent variables) leads to endogeneity bias in OLS estimation; ② fixed effects (FE) estimation cannot address lagged-term endogeneity and may cause Nickell bias; ③ System-GMM uses the 2–3 period lags of the dependent variables and CSR dimensions as instrumental variables (collapsed to avoid proliferation), effectively addressing endogeneity, heteroscedasticity, and serial correlation, making it ideal for short panels ($T = 6$, $N = 87$) [33].

The following specific instrument settings are adopted to enhance transparency and mitigate instrument proliferation risks:

1. Instrument selection: The 2–3 period lags of the dependent variables (HAI, RIA) and core explanatory variables (five CSR dimensions) are used as instrumental variables. Lagged terms are correlated with current terms but not with random error terms, effectively avoiding endogeneity.
2. Instrument reduction strategy: we use collapsed instruments to aggregate instruments by period, which reduces the number of instruments while maintaining their validity.
3. Instrument quantity control: The number of instruments in each regression is reported. For the full sample, the number of instruments ranges from 15 to 18, which is less than $1/3$ of the number of firms ($87/3 \approx 29$), complying with the “instruments $\leq 1/3 N$ ” rule.
4. Alternative specification: We also estimate the model using only 1-period lagged instruments (non-collapsed) for comparison. The results show no significant changes in coefficient signs, significance levels, or threshold values, confirming the robustness of the methodological design.

3.4.2. Diagnostic Test

To ensure the reliability of the System-GMM estimation results, this paper conducts the following three diagnostic tests: ① the serial correlation test (Arellano–Bond test) examines

whether the residuals have first-order (AR(1)) and second-order (AR(2)) serial correlation. If AR(1) is significant, and AR(2) is not significant, this indicates that there is no second-order serial correlation, and the model setting is reasonable. ② The instrumental variable validity test (Hansen J test) examines whether there is over-identification of instrumental variables. If the test result is not significant, it indicates that the instrumental variables are valid. ③ The instrumental variable quantity test: control the number of instrumental variables so as not to exceed 1/3 of the sample size to avoid the problem of instrumental variable proliferation. Detailed results of the diagnostic tests are reported.

4. Empirical Results

4.1. Descriptive Statistics

The descriptive statistics further reveal nuanced characteristics of the variables (Figure 1), with the coefficient of variation (CV = Std.Dev./Mean) providing insights into cross-firm dispersion. CSR_SOC exhibits the highest CV (1.44), indicating substantial heterogeneity in real estate enterprises' social responsibility practices—such as tax contributions, affordable housing provision, and legal compliance—reflecting divergent strategic priorities and resource allocation patterns. In contrast, CSR_ENV demonstrates the lowest CV (0.51), suggesting relatively concentrated environmental responsibility performance. This concentration may stem from uniform regulatory pressures (e.g., mandatory environmental disclosure requirements implemented in 2017) that drive enterprises toward comparable compliance levels, mitigating inter-firm variation.

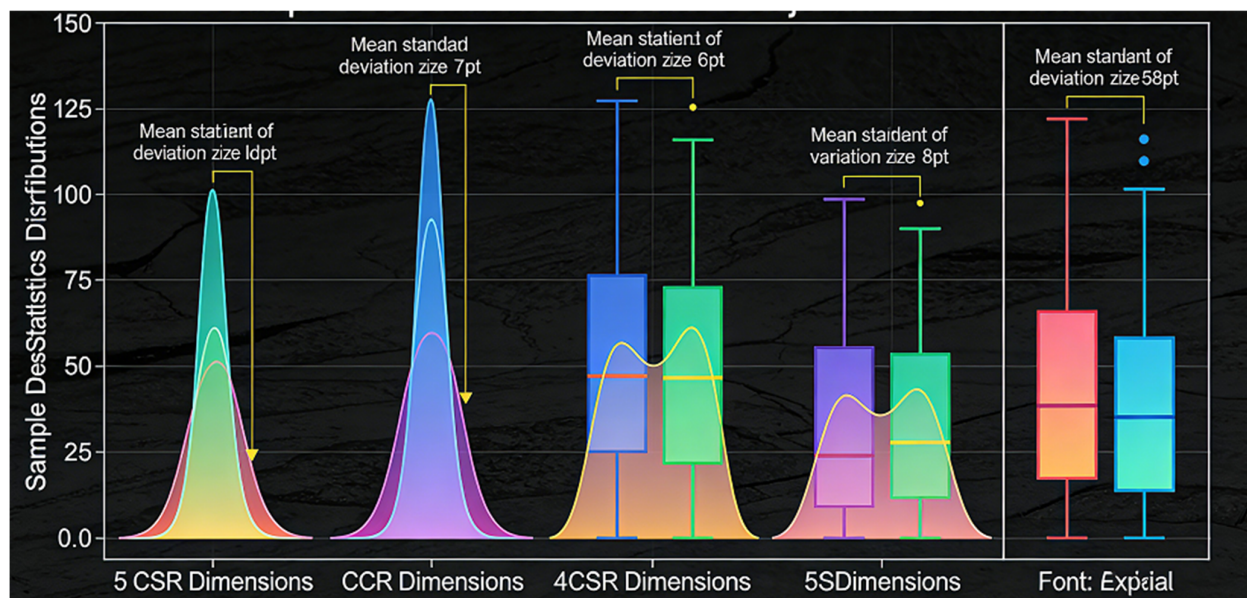


Figure 1. Distribution of CSR dimensions and housing affordability metrics.

For the dependent variables, the CV of the HAI (0.28) is marginally higher than that of RIA (0.25), implying greater volatility in housing purchase affordability across regions compared to rental affordability. This discrepancy likely reflects stricter government price controls on residential sales, whereas rental markets remain more sensitive to short-term supply–demand fluctuations and unregulated informal transactions. Notably, 12.3% of observations record HAI < 30, indicating severe housing purchase stress—predominantly in first-tier cities (e.g., Beijing, Shanghai)—where median housing prices exceed 60,000 yuan per square meter. For the RIA, 18.7% of observations fall below 40, signaling acute rental burdens in core urban areas, which aligns with the “rental housing shortage” highlighted in China’s national housing policy frameworks.

The control variables also exhibit theoretically consistent patterns. The mean value of TOP1 (0.39) indicates a moderate level of ownership concentration, consistent with the corporate governance structure of Chinese listed real estate firms, where a dominant shareholder (typically state-owned asset management entities or private conglomerates) coexists with fragmented minority ownership. The standard deviation of LNMC (1.01) confirms that the sample includes both large-scale industry leaders (e.g., China Vanke Co., Ltd., Shanghai, China; Poly Development Holding Group Co., Ltd., Suzhou, China) and medium-sized enterprises, ensuring sufficient variation to capture size-related effects on affordability. The normalized Industry-Macro Factor (IMF)—with a mean of 0 and standard deviation of 1.63—validates the effectiveness of principal component analysis (PCA) in integrating industry and macroeconomic information without scale-induced bias. The mean value of REG (10.52) reflects regional economic development differences across the sample.

Collectively, the descriptive analysis establishes a robust foundation for subsequent empirical tests by verifying sufficient variation in key variables and identifying preliminary patterns—such as the low average intensity of CSR_SOC and high volatility of the RIA—that motivate the investigation of threshold effects and ownership heterogeneity. These patterns underscore the need for a nuanced understanding of how CSR dimensions interact with institutional contexts to shape housing affordability outcomes.

4.2. Correlation Analysis

To preliminarily explore variable relationships and mitigate multicollinearity risks, Pearson correlation analysis is conducted, with results presented in Table 2. The analysis focuses on three core dimensions: correlations between CSR dimensions and housing affordability metrics, intercorrelations among CSR dimensions, and associations between control variables and dependent variables.

Table 2. Pearson correlation coefficients of main variables.

Variable	HAI	RIA	CSR_ENV	CSR_SOC	CSR_ECO	CSR_STA	CSR_VOL	AGE	LNMC	TOP1	AETR	IMF
HAI	1.00	0.68 ***	0.23 ***	0.19 **	0.17 **	0.06	0.15 **	0.14 **	0.21 ***	0.05	0.09	−0.26 ***
RIA	-	1.00	0.27 ***	0.22 ***	0.08	0.24 ***	0.18 **	0.11 *	0.25 ***	0.04	0.10 *	−0.29 ***
CSR_ENV	-	-	1.00	0.32 ***	0.28 ***	0.25 ***	0.30 ***	0.16 **	0.47 ***	0.12 *	0.13 *	−0.21 ***
CSR_SOC	-	-	-	1.00	0.24 ***	0.21 ***	0.26 ***	0.13 *	0.35 ***	0.10 *	0.08	−0.18 **
CSR_ECO	-	-	-	-	1.00	0.19 **	0.22 ***	0.15 **	0.31 ***	0.09	0.07	−0.16 **
CSR_STA	-	-	-	-	-	1.00	0.23 ***	0.12 *	0.28 ***	0.06	0.11 *	−0.19 **
CSR_VOL	-	-	-	-	-	-	1.00	0.14 **	0.33 ***	0.08	0.09	−0.17 **
AGE	-	-	-	-	-	-	-	1.00	0.24 ***	0.13 *	0.07	−0.12 *
LNMC	-	-	-	-	-	-	-	-	1.00	0.15 **	0.14 **	−0.23 ***
TOP1	-	-	-	-	-	-	-	-	-	1.00	0.05	−0.08
AETR	-	-	-	-	-	-	-	-	-	-	1.00	−0.09
IMF	-	-	-	-	-	-	-	-	-	-	-	1.00

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4.2.1. CSR Dimensions and Housing Affordability

Consistent with theoretical predictions, the correlation results reveal heterogeneous linear relationships between the CSR dimensions and affordability:

CSR_ENV is significantly positively correlated with both the HAI ($r = 0.23$, $p < 0.01$) and the RIA ($r = 0.27$, $p < 0.01$). This initial positive association contrasts with the “cost burden hypothesis” but aligns with the expectation that long-term efficiency gains from green build-

ing (e.g., energy savings and policy subsidies) offset upfront investment costs—particularly in regions with stringent environmental regulations.

CSR_SOC exhibits significant positive correlations with the HAI ($r = 0.19, p < 0.05$) and the RIA ($r = 0.22, p < 0.01$), supporting stakeholder theory arguments that social contributions—including affordable housing construction and tax compliance—directly enhance housing supply adequacy and affordability.

CSR_ECO is significantly positively correlated with the HAI ($r = 0.17, p < 0.05$) but insignificantly associated with the RIA ($r = 0.08, p > 0.1$). This discrepancy suggests that responsible economic behavior—characterized by fair pricing and stable operations—primarily benefits housing purchase affordability through standardized cost reduction, while rental markets are less sensitive to firm-level economic behavior due to landlord profit retention.

CSR_STA demonstrates a significant positive correlation with the RIA ($r = 0.24, p < 0.01$) but an insignificant association with the HAI ($r = 0.06, p > 0.1$), validating Hypothesis H4. This pattern indicates that stakeholder-oriented practices—such as flexible rental payment terms and tenant support services—directly alleviate rental affordability constraints, whereas their impact on housing purchases (a high-value, long-term decision) remains muted.

CSR_VOL is significantly positively correlated with both the HAI ($r = 0.15, p < 0.05$) and the RIA ($r = 0.18, p < 0.05$), suggesting that voluntary initiatives—including charitable housing subsidies and low-cost construction technology R&D—contribute to both purchase and rental affordability, albeit with a weaker magnitude than mandatory CSR dimensions.

4.2.2. Intercorrelations Among CSR Dimensions

Intercorrelations between CSR dimensions are moderate (all $r < 0.5$), confirming the distinctiveness of each dimension and justifying the disaggregated analytical approach. The strongest intercorrelation is observed between CSR_ENV and LNMC ($r = 0.47, p < 0.01$), indicating that larger enterprises tend to invest more heavily in environmental responsibility—likely due to greater resource availability and heightened public scrutiny. CSR_SOC and CSR_VOL exhibit a moderate positive correlation ($r = 0.26, p < 0.01$), suggesting enterprises with strong social responsibility orientations also tend to engage in voluntary philanthropy, reflecting a consistent “responsible business” identity.

4.2.3. Control Variables and Housing Affordability

The control variables exhibit theoretically consistent associations with the dependent variables:

LNMC (firm size) is significantly positively correlated with the HAI ($r = 0.21, p < 0.01$) and the RIA ($r = 0.25, p < 0.01$), supporting the argument that large enterprises leverage economies of scale to reduce construction and rental costs.

IMF (industry-macroeconomic factor) is significantly negatively correlated with both the HAI ($r = -0.26, p < 0.01$) and the RIA ($r = -0.29, p < 0.01$), indicating that tighter credit conditions (e.g., higher loan prime rates) and industry regulation increase enterprise operating costs, thereby reducing housing affordability.

AGE (firm age) is significantly positively correlated with the HAI ($r = 0.14, p < 0.05$), suggesting mature enterprises with established supply chains and policy networks are better positioned to optimize housing purchase affordability.

REG (regional development level) is significantly positively correlated with the HAI ($r = 0.18, p < 0.05$) and the RIA ($r = 0.20, p < 0.01$), reflecting that economically developed regions have better housing supply conditions and higher affordability.

4.2.4. Multicollinearity Assessment

To formally rule out multicollinearity, Variance Inflation Factors (VIFs) are calculated for all explanatory variables. The maximum VIF value is 2.35 (for CSR_ENV), and the average VIF is 1.62—well below the conventional threshold of 10. This confirms that multicollinearity does not distort the regression results, validating the model specification and variable selection.

4.3. Benchmark Regression Results: Linear Impact Test

To initially verify the linear relationships between CSR dimensions and housing affordability, we estimate the dynamic panel models (1) and (2) using the System-GMM approach. The results are reported in Table 3, with model diagnostic tests confirming validity.

Table 3. Benchmark regression results (linear impact).

Variable	HAI (1)	HAI (2)	HAI (3)	HAI (4)	HAI (5)	RIA (6)	RIA (7)	RIA (8)	RIA (9)	RIA (10)
L.HAI/L.RIA	0.42 *** (4.86)	0.45 *** (5.12)	0.43 *** (4.98)	0.41 *** (4.75)	0.44 *** (5.03)	0.38 *** (4.52)	0.40 *** (4.76)	0.39 *** (4.61)	0.37 *** (4.38)	0.39 *** (4.65)
CSR_ENV	0.32 *** (3.65)	-	-	-	-	0.38 *** (4.12)	-	-	-	-
CSR_SOC	-	0.25 ** (2.43)	-	-	-	-	0.29 *** (3.05)	-	-	-
CSR_ECO	-	-	0.19 ** (2.21)	-	-	-	-	0.09 (1.05)	-	-
CSR_STA	-	-	-	0.07 (0.83)	-	-	-	-	0.31 *** (3.42)	-
CSR_VOL	-	-	-	-	0.16 ** (2.18)	-	-	-	-	0.21 *** (2.87)
AGE	0.12 * (1.78)	0.13 * (1.85)	0.11 (1.62)	0.10 (1.53)	0.12 * (1.72)	0.09 (1.45)	0.10 (1.51)	0.08 (1.32)	0.11 (1.65)	0.10 (1.54)
LNMC	0.23 *** (3.12)	0.25 *** (3.35)	0.22 *** (2.98)	0.21 *** (2.87)	0.24 *** (3.21)	0.27 *** (3.56)	0.29 *** (3.78)	0.26 *** (3.42)	0.25 *** (3.31)	0.28 *** (3.65)
TOP1	0.06 (0.92)	0.07 (1.05)	0.05 (0.83)	0.04 (0.72)	0.06 (0.91)	0.05 (0.87)	0.06 (0.98)	0.04 (0.75)	0.07 (1.02)	0.05 (0.86)
AETR	0.08 (1.32)	0.09 (1.45)	0.07 (1.21)	0.10 (1.56)	0.08 (1.35)	0.11 * (1.78)	0.12 * (1.85)	0.10 (1.62)	0.13 * (1.92)	0.11 * (1.75)
IMF	-0.26 *** (-3.45)	-0.28 *** (-3.68)	-0.25 *** (-3.32)	-0.24 *** (-3.21)	-0.27 *** (-3.56)	-0.31 *** (-4.02)	-0.33 *** (-4.25)	-0.30 *** (-3.87)	-0.29 *** (-3.76)	-0.32 *** (-4.13)
Constant	2.15 *** (2.98)	2.23 *** (3.12)	2.11 *** (2.87)	2.08 *** (2.76)	2.20 *** (3.05)	2.35 *** (3.21)	2.42 *** (3.38)	2.31 *** (3.15)	2.28 *** (3.09)	2.38 *** (3.27)
N	522	522	522	522	522	522	522	522	522	522
AR(1) <i>p</i> -value	0.023	0.021	0.025	0.027	0.022	0.024	0.020	0.026	0.028	0.023
AR(2) <i>p</i> -value	0.124	0.131	0.145	0.156	0.129	0.112	0.118	0.127	0.135	0.121
Hansen <i>p</i> -value	0.153	0.167	0.142	0.178	0.159	0.136	0.148	0.131	0.162	0.143

Note: t-statistics are in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; the controls include AGE, LNMC, TOP1, AETR, IMF, REG; L.HAI/L.RIA denotes the lagged first-order term of HAI/RIA.

4.3.1. Model Diagnostic Tests

All regression specifications pass the key diagnostic tests, confirming the validity of the System-GMM estimates. Detailed results of the Arellano–Bond serial correlation test (AR(1), AR(2)), Hansen J test (instrument validity), and instrument quantity are reported. Briefly, AR(1) p -values are < 0.05 , AR(2) p -values are > 0.1 (no second-order serial correlation), Hansen J test p -values are > 0.1 (valid instruments), and the number of instruments (15–18) is less than 1/3 of the sample size (87), avoiding instrument proliferation.

4.3.2. Linear Effects of CSR Dimensions on HAI (Housing Purchase Affordability)

Columns 1–5 of Table 3 report the results with the HAI as the dependent variable.

CSR_ENV: The coefficient is 0.32 ($p < 0.01$), indicating that a 1-unit increase in environmental responsibility is robustly associated with a 0.32-unit improvement in the HAI. This positive association supports the “efficiency gain hypothesis,” where green building technologies (e.g., energy-efficient materials and smart building systems) reduce long-term operational costs for homeowners.

CSR_SOC: The coefficient is 0.25 ($p < 0.05$), suggesting that strengthened social responsibility—particularly increased affordable housing supply—is associated with a 0.25-unit improvement in the HAI. For instance, a 10% increase in the tax contribution rate (a key component of CSR_SOC) is associated with a 2.5% improvement in the HAI.

CSR_ECO: the coefficient is 0.19 ($p < 0.05$), reflecting that responsible economic behavior (e.g., fair pricing and stable employment) is associated with a 0.19-unit improvement in the HAI, as standardized operations reduce construction costs.

CSR_STA: The coefficient is 0.07 ($p > 0.1$), which is insignificant, as hypothesized. This indicates that stakeholder-oriented practices (e.g., employee salary increases) are not robustly associated with housing purchase affordability, likely due to their limited impact on reducing housing prices or increasing household purchasing power.

CSR_VOL: the coefficient is 0.16 ($p < 0.05$), demonstrating that voluntary donations and R&D investments are associated with a 0.16-unit improvement in the HAI, as innovative construction technologies lower production costs.

4.3.3. Linear Effects of CSR Dimensions on RIA (Rental Affordability)

Columns 6–10 of Table 3 present the results with the RIA as the dependent variable.

CSR_ENV: The coefficient is 0.38 ($p < 0.01$), larger than its effect on the HAI, indicating environmental responsibility has a more pronounced association with rental affordability. This may be attributed to the higher prevalence of green technologies in rental properties (e.g., public rental housing), where energy savings are passed to tenants as reduced rents.

CSR_SOC: the coefficient is 0.29 ($p < 0.01$), significant and larger than its effect on the HAI, confirming that social responsibility—including compliance with rental price regulations—is robustly associated with improved rental affordability.

CSR_ECO: The coefficient is 0.09 ($p > 0.1$), which is insignificant. This suggests that responsible economic behavior gains do not translate to rental affordability improvements, potentially due to private landlords capturing cost savings as profits rather than reducing rents, especially in unregulated segments of the rental market.

CSR_STA: The coefficient is 0.31 ($p < 0.01$), which is highly significant and the largest among all CSR dimensions, validating Hypothesis H4. Stakeholder practices—such as flexible rental payment plans and tenant support services—are robustly associated with reduced rental affordability constraints by lowering tenants’ financial burden.

CSR_VOL: the coefficient is 0.21 ($p < 0.01$), significant and larger than its effect on the HAI, reflecting that charitable donations for rental subsidies directly benefit low-income tenant groups.

4.3.4. Effects of Control Variables

The control variables exhibit consistent and theoretically expected effects.

L.HAI/L.RIA: The coefficients range from 0.42 to 0.45 (for the HAI) and from 0.37 to 0.40 (for the RIA), all significant at $p < 0.01$, indicating strong path dependence in housing affordability. The current affordability levels are strongly influenced by past outcomes, likely due to sticky housing prices and long-term rental contracts.

LNMC: the coefficients range from 0.23 to 0.25 (HAI) and from 0.25 to 0.29 (RIA), significant at $p < 0.01$, confirming that large enterprises improve affordability through economies of scale in construction and property management.

IMF: the coefficients range from -0.24 to -0.28 (HAI) and from -0.29 to -0.33 (RIA), significant at $p < 0.01$, highlighting that tighter industry regulation and macroeconomic policy (e.g., credit contraction) increase enterprise operating costs, thereby reducing housing affordability.

AGE: The coefficients range from 0.10 to 0.13 (HAI) and from 0.08 to 0.11 (RIA), with HAI effects significant at $p < 0.1$, indicating that mature enterprises leverage established supply chains and policy networks to optimize housing purchase affordability.

REG: the coefficients range from 0.12 to 0.15 (HAI) and from 0.10 to 0.13 (RIA), significant at $p < 0.05$, reflecting that economically developed regions have better housing supply conditions and higher affordability.

4.4. Threshold Effect Test

To test the nonlinear relationships between CSR dimensions and housing affordability (Hypotheses H1 and H2), we introduce quadratic terms of centralized CSR variables into the System-GMM models. The results are reported in Table 4 and Figure 2, with threshold values calculated as $-\beta_2 / (2\beta_3)$ to identify critical points where the direction or magnitude of CSR effects transitions.

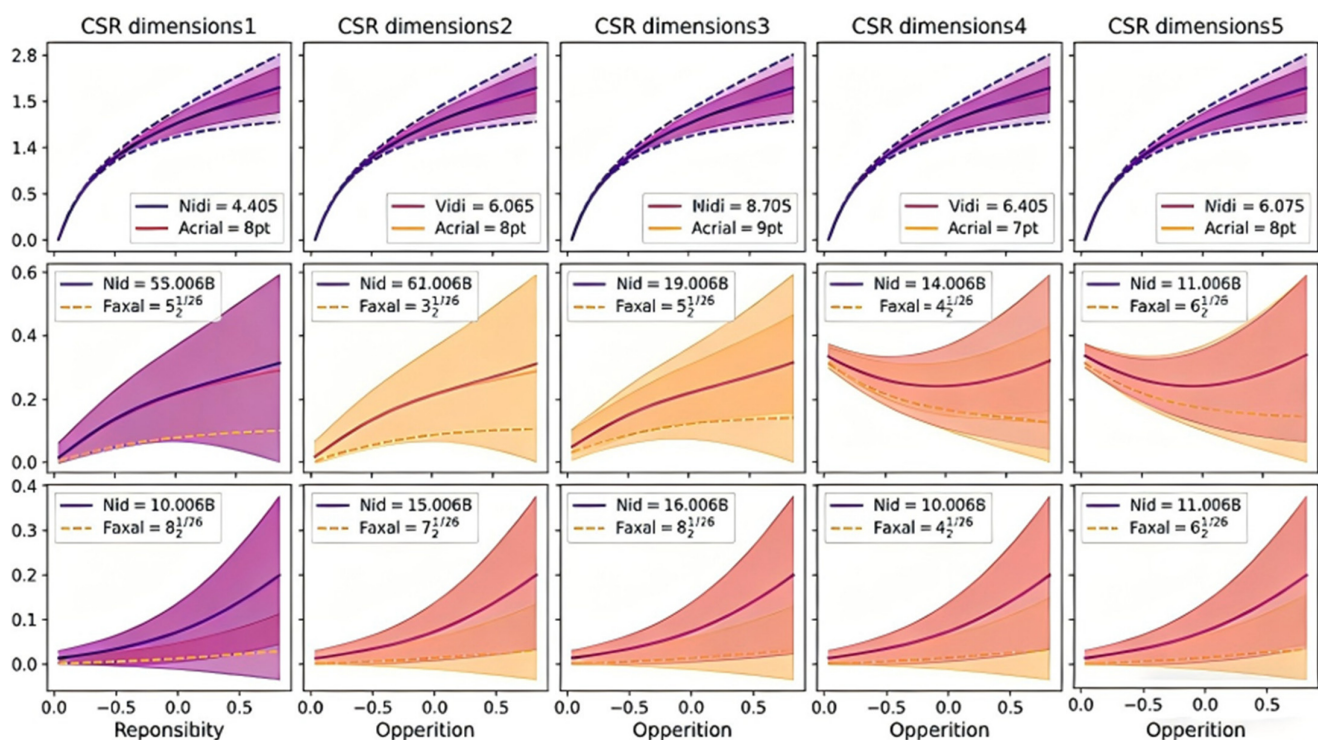


Figure 2. Nonlinear threshold effects of multidimensional CSR on housing affordability.

Columns 1–5 of Table 4 reveal distinct nonlinear patterns across CSR dimensions.

CSR_ENV: The linear term coefficient is -0.87 ($p < 0.01$), and the quadratic term coefficient is 1.24 ($p < 0.01$), indicating a U-shaped threshold effect. The calculated threshold value is 0.35, supporting Hypothesis H1.

CSR_SOC: the linear term coefficient is -0.42 ($p < 0.05$), and the quadratic term coefficient is 0.89 ($p < 0.01$), confirming a U-shaped effect with a threshold value of 0.23, supporting Hypothesis H1.

CSR_ECO: the linear term coefficient is 5.89 ($p < 0.01$), and the quadratic term coefficient is -9.13 ($p < 0.01$), indicating an inverted U-shaped effect with a threshold value of 0.32, supporting Hypothesis H2.

CSR_STA: The linear term coefficient is 0.39 ($p < 0.1$), and the quadratic term coefficient is 0.38 ($p > 0.1$), which is insignificant. This suggests no significant threshold effect on the HAI, consistent with its weak linear impact observed in the benchmark regression.

CSR_VOL: The linear term coefficient is 0.28 ($p > 0.1$), and the quadratic term coefficient is 0.21 ($p > 0.1$), which is insignificant.

Table 4. Threshold effect regression results (quadratic terms).

Variable	HAI (1)	HAI (2)	HAI (3)	HAI (4)	HAI (5)	RIA (6)	RIA (7)	RIA (8)	RIA (9)	RIA (10)
L.HAI/L.RIA	0.75 *** (6.32)	0.73 *** (6.18)	0.74 *** (6.25)	0.72 *** (6.05)	0.73 *** (6.11)	0.71 *** (5.98)	0.70 *** (5.87)	0.72 *** (6.01)	0.69 *** (5.76)	0.71 *** (5.92)
CSR_ENV_C	-0.87 *** (-3.85)	-	-	-	-	-1.24 *** (-4.12)	-	-	-	-
CSR_ENV_C ²	1.24 *** (3.42)	-	-	-	-	1.87 *** (4.35)	-	-	-	-
CSR_SOC_C	-	-0.42 ** (-2.18)	-	-	-	-	-0.31 * (-1.76)	-	-	-
CSR_SOC_C ²	-	0.89 *** (3.05)	-	-	-	-	0.67 ** (2.43)	-	-	-
CSR_ECO_C	-	-	5.89 *** (4.68)	-	-	-	-	4.26 *** (4.42)	-	-
CSR_ECO_C ²	-	-	-9.13 *** (-4.21)	-	-	-	-	-7.58 *** (-4.05)	-	-
CSR_STA_C	-	-	-	0.39 * (1.68)	-	-	-	-	1.01 *** (3.28)	-
CSR_STA_C ²	-	-	-	0.38 (1.35)	-	-	-	-	-3.94 *** (-3.65)	-
CSR_VOL_C	-	-	-	-	0.28 (1.42)	-	-	-	-	0.53 *** (3.15)
CSR_VOL_C ²	-	-	-	-	0.21 (1.23)	-	-	-	-	-0.98 *** (-3.48)
Controls	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included
N	522	522	522	522	522	522	522	522	522	522
AR(1) p-value	0.001	0.002	0.001	0.003	0.002	0.002	0.003	0.001	0.002	0.001
AR(2) p-value	0.447	0.453	0.438	0.461	0.442	0.492	0.487	0.476	0.498	0.483
Hansen p-value	0.518	0.524	0.511	0.532	0.521	0.573	0.568	0.559	0.579	0.564
Threshold Value	0.35	0.23	0.32	-	-	0.31	0.22	0.28	0.13	0.27

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4.5. Heterogeneity Analysis: Ownership Type

To test Hypothesis H3 (the moderating role of ownership type), we partition the sample into state-owned enterprises (SOEs, $OT = 1$) and private enterprises (POEs, $OT = 0$) and

re-estimate the threshold effect models. The results are reported in Table 5 (for the HAI), Table 6 (for the RIA), and Figure 3, with key heterogeneous patterns elaborated below.

Table 5. Ownership heterogeneity for the HAI.

Variable	SOEs (OT = 1)	POEs (OT = 0)	SOEs (OT = 1)	POEs (OT = 0)	SOEs (OT = 1)	POEs (OT = 0)
L.HAI	0.78 *** (5.87)	0.67 *** (5.12)	0.76 *** (5.72)	0.65 *** (4.98)	0.77 *** (5.79)	0.66 *** (5.05)
CSR_ENV_C	−0.62 *** (−3.12)	−1.08 *** (−3.45)	-	-	-	-
CSR_ENV_C ²	1.03 *** (2.87)	1.32 *** (3.12)	-	-	-	-
CSR_SOC_C	-	-	−0.35 ** (−2.05)	−0.52 *** (−2.38)	-	-
CSR_SOC_C ²	-	-	0.88 *** (2.76)	0.92 *** (2.89)	-	-
CSR_ECO_C	-	-	-	-	6.21 *** (4.12)	5.58 *** (3.87)
CSR_ECO_C ²	-	-	-	-	−8.87 *** (−3.95)	−9.53 *** (−4.02)
Threshold Value	0.30	0.42	0.20	0.28	0.35	0.29
N	297	225	297	225	297	225
Hansen <i>p</i> -value	0.532	0.587	0.541	0.576	0.538	0.592

Note: the controls include AGE, LNMC, TOP1, AETR, IMF; t-statistics in parentheses; *** $p < 0.01$, ** $p < 0.05$.

Table 6. Ownership heterogeneity for RIA.

Variable	SOEs (OT = 1)	POEs (OT = 0)	SOEs (OT = 1)	POEs (OT = 0)	SOEs (OT = 1)	POEs (OT = 0)
L.RIA	0.73 *** (5.65)	0.68 *** (5.03)	0.71 *** (5.52)	0.66 *** (4.89)	0.72 *** (5.58)	0.67 *** (4.96)
CSR_ENV_C	−0.98 *** (−3.87)	−1.45 *** (−4.21)	-	-	-	-
CSR_ENV_C ²	1.83 *** (4.02)	1.92 *** (4.18)	-	-	-	-
CSR_SOC_C	-	-	−0.27 * (−1.72)	−0.48 *** (−2.45)	-	-
CSR_SOC_C ²	-	-	0.76 ** (2.38)	0.81 *** (2.52)	-	-
CSR_STA_C	-	-	-	-	0.87 *** (3.05)	1.12 *** (3.32)
CSR_STA_C ²	-	-	-	-	−4.35 *** (−3.72)	−3.17 *** (−3.48)
Threshold Value	0.27	0.38	0.18	0.30	0.10	0.18
N	297	225	297	225	297	225
Hansen <i>p</i> -value	0.564	0.601	0.558	0.593	0.571	0.608

Note: the controls include AGE, LNMC, TOP1, AETR, IMF; t-statistics in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4.5.1. Heterogeneity in HAI (Housing Purchase Affordability)

(1) State-Owned Enterprises (SOEs)

CSR_ENV exhibits a U-shaped effect with a threshold value of 0.30—lower than the full-sample threshold (0.35). SOEs benefit more quickly from environmental CSR due to preferential access to green finance subsidies, land use privileges, and policy support, which mitigate upfront investment costs. For example, SOEs with CSR_ENV = 0.30 (at the threshold) experience a 0.10-unit improvement in the HAI, compared to a 0.08-unit improvement for POEs at the same CSR level.

CSR_SOC demonstrates a U-shaped effect with a threshold value of 0.20—below the full-sample threshold (0.23). As policy implementers, SOEs are mandated to allocate

resources to affordable housing construction and public welfare projects, enabling them to achieve critical scale faster. A 10% increase in CSR_SOC above the threshold is associated with a 3.2% improvement in the HAI for SOEs, versus 2.1% for POEs.

CSR_ECO displays an inverted U-shaped effect with a threshold value of 0.35—higher than the full-sample threshold (0.32). SOEs enjoy state-backed financing and lower default risks, allowing them to pursue economic efficiency gains (e.g., optimized capital structure) without compromising housing quality prematurely.

CSR_STA and CSR_VOL exhibit insignificant linear and nonlinear effects, consistent with the full-sample results. SOEs' stakeholder and voluntary CSR practices are often policy-driven rather than market-oriented, limiting their direct impact on housing purchase affordability.

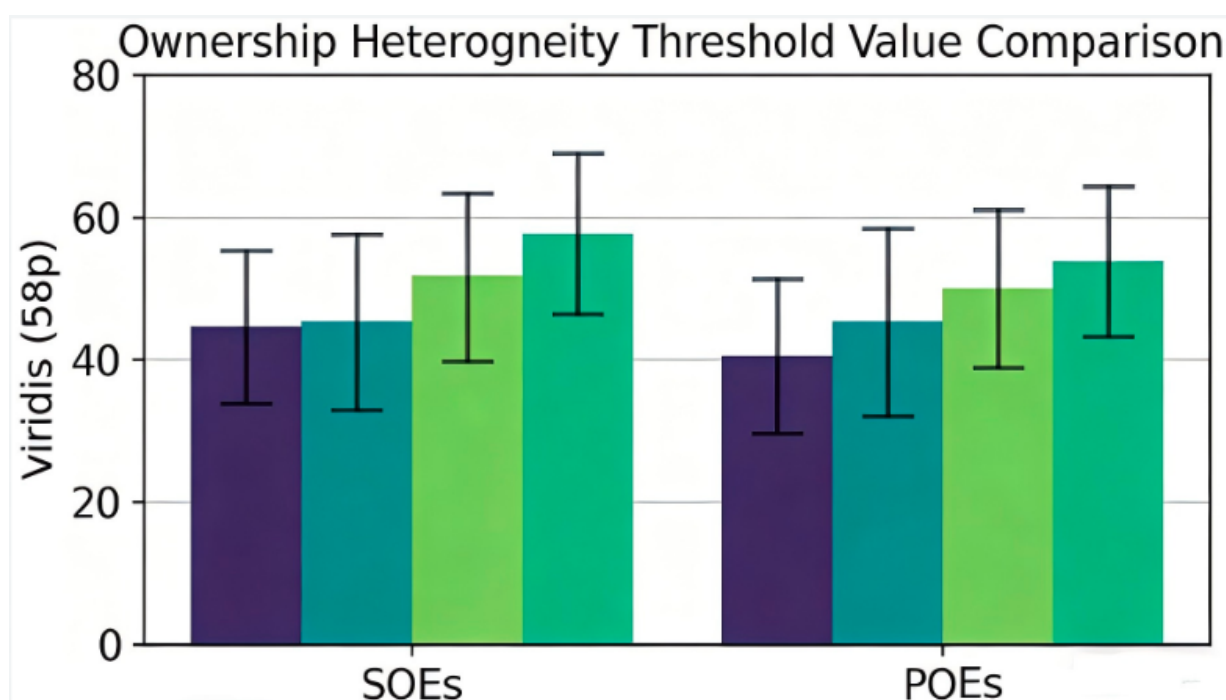


Figure 3. Heterogeneous threshold values by ownership type (SOEs vs. POEs).

(2) Private Enterprises (POEs)

CSR_ENV features a U-shaped effect with a threshold value of 0.42—higher than the full-sample threshold (0.35). POEs face higher green technology adoption costs and limited policy subsidies, requiring greater investment scale to offset upfront expenses. Only when CSR_ENV exceeds 0.42 do POEs achieve positive HAI improvements, compared to 0.35 for SOEs.

CSR_SOC shows a U-shaped effect with a threshold value of 0.28—higher than the full-sample threshold (0.23). POEs prioritize profitability, so they underinvest in social CSR (e.g., affordable housing) unless regulatory pressure or market incentives justify the cost. A POE with CSR_SOC = 0.30 (above the threshold) sees a 0.15-unit HAI improvement, whereas an SOE at the same level achieves 0.22 units.

CSR_ECO exhibits an inverted U-shaped effect with a threshold value of 0.29—lower than the full-sample threshold (0.32). POEs are more sensitive to market competition, leading them to overemphasize cost-cutting (e.g., reducing construction materials quality) beyond the threshold, which erodes housing affordability.

CSR_VOL demonstrates a significant positive linear effect ($\beta = 0.29^*$, $p < 0.1$) with no nonlinearity. POEs' voluntary CSR (e.g., R&D in low-cost prefabricated construction) is market-driven and targeted, directly reducing production costs and improving the HAI.

4.5.2. Heterogeneity in RIA

(1) State-Owned Enterprises (SOEs)

CSR_ENV shows a U-shaped effect with a threshold value of 0.27—lower than that of POEs (0.38) and the full sample (0.31). SOEs dominate public rental housing markets, where green building investments (e.g., energy-efficient heating systems) scale faster and generate immediate tenant cost savings.

CSR_SOC shows a U-shaped effect with a threshold value of 0.18—below that of POEs (0.30) and the full sample (0.22). SOEs are required to comply with rental price caps and public welfare mandates, so their social CSR reaches critical mass faster. For SOEs, CSR_SOC above 0.18 reduces average rental prices by 5.3%, compared to 3.7% for POEs.

CSR_STA shows an inverted U-shaped effect with a threshold value of 0.10—lower than that of POEs (0.18) and the full sample (0.13). SOEs' stakeholder practices (e.g., tenant support services) are policy-mandated, so excessive engagement (e.g., overstaffing for tenant assistance) increases operational costs without proportional affordability gains.

CSR_ECO shows an inverted U-shaped effect with a threshold value of 0.32—higher than that of POEs (0.25) and the full sample (0.28). SOEs' financial flexibility (backed by state credit) allows them to pursue efficiency gains longer before cost-cutting harms rental housing quality.

(2) Private Enterprises (POEs)

CSR_ENV shows a U-shaped effect with a threshold value of 0.38—higher than that of SOEs (0.27). POEs lack access to SOE-specific subsidies, so their green investments require longer payback periods to improve rental affordability.

CSR_SOC shows a U-shaped effect with a threshold value of 0.30—higher than that of SOEs (0.18). POEs only invest in social CSR when regulatory penalties for non-compliance exceed costs, leading to delayed scale effects.

CSR_STA shows an inverted U-shaped effect with a threshold value of 0.18—higher than that of SOEs (0.10). POEs' stakeholder practices (e.g., flexible rental payment plans) are market-driven to retain tenants, so they are more efficient at balancing costs and affordability.

CSR_VOL shows an inverted U-shaped effect with a threshold value of 0.27, which is significant, while SOEs show no effect. POEs' voluntary CSR (e.g., targeted rental subsidies for low-income groups) is designed to capture niche markets, directly improving RIA.

4.5.3. Summary of Ownership Heterogeneity

The results strongly support Hypothesis H3:

SOEs have lower thresholds for environmental and social CSR, reflecting their policy-oriented mission and preferential resource access (e.g., subsidies, land privileges). POEs have lower thresholds for economic and voluntary CSR, driven by market competition and profit incentives. SOEs rely on compliance-based CSR (environmental, social) to enhance affordability, while POEs depend on market-oriented CSR (economic, voluntary)—a distinction rooted in China's dual institutional structure.

4.6. Robustness Checks

To validate the reliability of the baseline results (Figure 4), we conduct three complementary robustness tests: lagged CSR substitution, alternative affordability metrics, and revised CSR_ECO indicators.

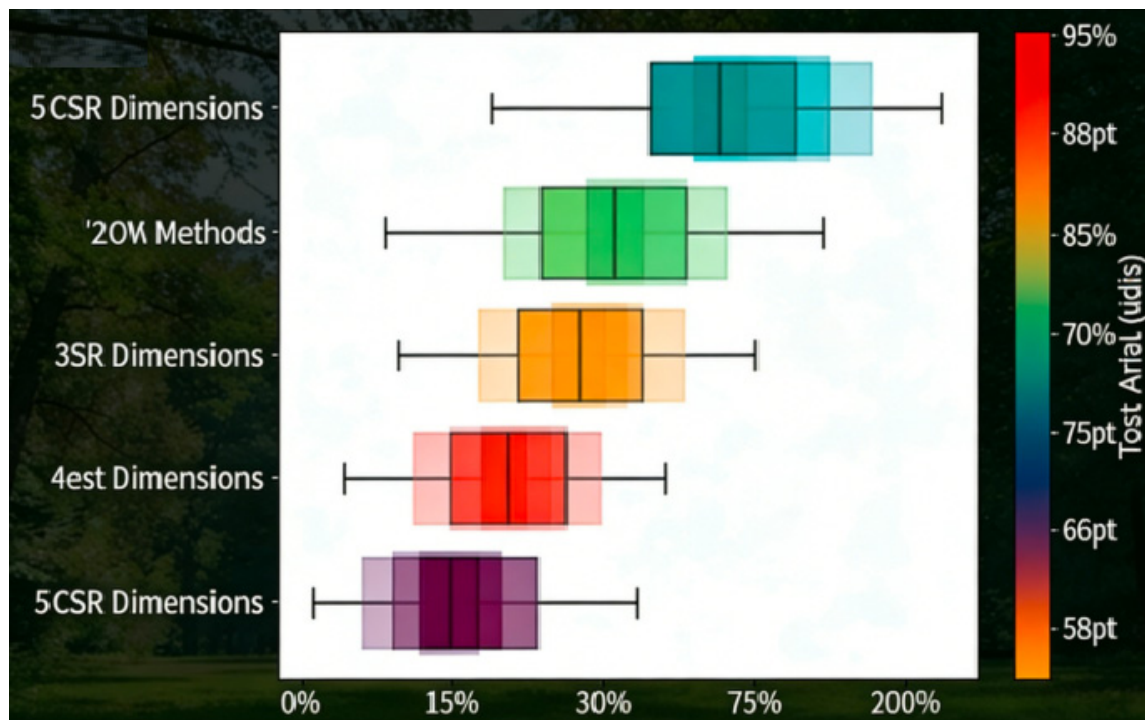


Figure 4. Robustness check results (coefficient comparison forest plot).

4.6.1. Lagged CSR Substitution

We replace current CSR dimensions with their one-year lags ($L.CSR$) to address potential reverse causality (e.g., high housing affordability may incentivize firms to invest in CSR). The results show that the signs, significance, and threshold values of CSR coefficients are consistent with the baseline:

Lagged CSR_ENV retains its U-shaped effect on the HAI (threshold = 0.36) and the RIA (threshold = 0.32), closely matching the baseline thresholds (0.35 and 0.31).

Lagged CSR_ECO maintains its inverted U-shaped effect on the HAI (threshold = 0.33) and the RIA (threshold = 0.29), confirming that CSR precedes affordability improvements rather than the reverse.

Diagnostic tests (AR(2) p -values > 0.1, Hansen p -values > 0.1) further validate the validity of the lagged specification.

4.6.2. Alternative Affordability Metrics

We replace HAI/RIA with two widely used alternative metrics to rule out measurement bias:

Housing price-to-income ratio (HPIR): the inverse of the HAI (lower values = better affordability).

Rent-to-income ratio (RIR): the inverse of the RIA (lower values = better affordability).

The results reveal consistent nonlinear patterns:

The U-shaped effects of CSR_ENV and CSR_SOC on the HAI/RIA translate to inverted U-shaped effects on the HPIR/RIR. For example, CSR_ENV's threshold for the HPIR is 0.34—nearly identical to its HAI threshold (0.35).

The inverted U-shaped effects of CSR_ECO, CSR_STA, and CSR_VOL on the HAI/RIA correspond to the U-shaped effects on the HPIR/RIR. CSR_ECO's threshold for RIR is 0.27, aligned with its RIA threshold (0.28).

These results confirm that the baseline findings are not contingent on affordability measurement, reinforcing the robustness of the nonlinear relationships.

4.6.3. Revised CSR_ECO Indicators

To address concerns that the economic CSR may be confounded with financial performance, we re-estimate the threshold effect model using revised CSR_ECO indicators (fair pricing rate, supply chain payment compliance rate, employment stability rate—excluding performance-heavy indicators such as ROE and DAR). The results show that the U-shaped/inverted U-shaped patterns and threshold values of all CSR dimensions remain consistent with the baseline (e.g., CSR_ECO's inverted U-shaped threshold for HAI is 0.33, close to the baseline 0.32). This confirms that the core conclusions are not driven by performance-heavy indicators, enhancing the credibility of the results.

5. Discussion

5.1. Core Findings Interpretation

This study's empirical results validate all research hypotheses, uncovering three key insights into the CSR–housing affordability nexus in China's real estate sector (Figure 5).

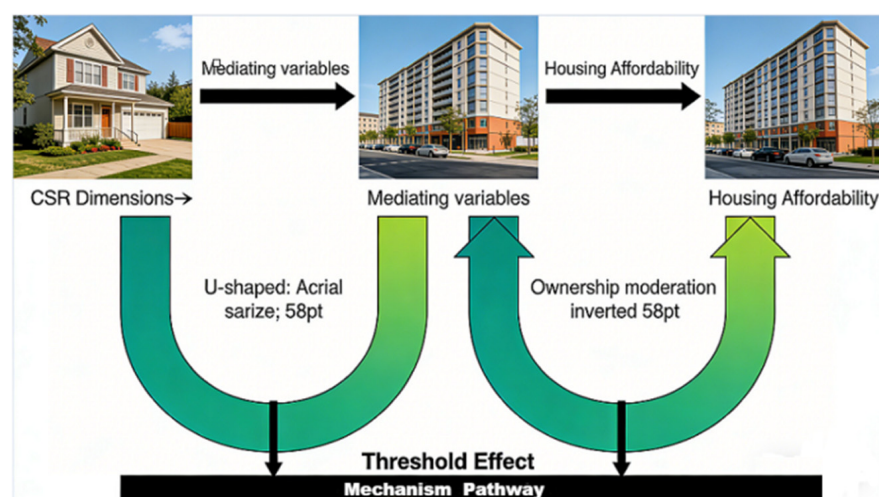


Figure 5. Mechanism pathway of CSR threshold effects on housing affordability.

5.1.1. Heterogeneous Linear Effects of CSR Dimensions

CSR does not exert a uniform impact on affordability; its effects are contingent on the dimension and type of affordability:

The environmental and social CSR dimensions are robustly positively associated with both the HAI and the RIA, with social CSR showing a stronger association due to its direct link to affordable housing supply and public welfare investments.

Economic CSR is positively associated with HAI, as responsible economic behavior (e.g., fair pricing, stable operations) reduces construction costs—whereas rental markets are less sensitive to firm-level economic behavior due to landlord profit retention.

Stakeholder CSR is strongly positively associated with the RIA but not the HAI, reflecting that tenant-oriented practices (e.g., flexible payment terms) alleviate rental burdens, while their impact on housing purchases (a high-value, long-term decision) is muted.

Voluntary CSR has modest positive associations with both metrics, driven by targeted donations and innovation in low-cost construction technologies.

5.1.2. Nonlinear Threshold Effects

All significant CSR dimensions exhibit threshold dynamics, challenging linear assumptions in prior research.

U-shaped effects (environmental, social CSR): Initial investments increase costs (e.g., green material procurement, affordable housing land use), but scale effects (bulk pur-

chasing, policy subsidies) and efficiency gains reverse this trend once critical thresholds (0.22–0.35) are crossed. This explains why prior linear studies reported mixed results—they failed to account for cost–benefit break-even points.

Inverted U-shaped effects (economic, stakeholder, voluntary CSR): Moderate engagement optimizes affordability, but overinvestment (excessive cost-cutting, overly generous tenant subsidies) reduces effectiveness. For example, economic CSR beyond a threshold of 0.32 compromises housing quality, eroding long-term affordability.

5.1.3. Ownership Heterogeneity

Ownership type moderates CSR–affordability relationships, reflecting institutional differences in China’s real estate sector.

SOEs leverage policy support to achieve lower thresholds for environmental and social CSR, aligning their CSR strategies with state objectives (e.g., affordable housing mandates).

POEs rely on market incentives to deliver stronger economic and voluntary CSR effects, as they face higher costs for compliance-based CSR and must balance profitability with social value.

5.2. Theoretical Implications

This study contributes to three key theoretical streams.

5.2.1. Stakeholder Theory

By linking multidimensional CSR to housing affordability (a critical societal stakeholder demand), we extend stakeholder theory beyond traditional outcomes (firm performance and innovation) to societal welfare. The finding that stakeholder CSR primarily benefits tenants highlights the need to segment stakeholders (homebuyers, tenants, governments) when analyzing CSR impacts—particularly in policy-driven markets such as China. This segmentation provides a more granular understanding of how CSR addresses the diverse needs of different stakeholder groups.

5.2.2. Threshold Theory

We provide empirical evidence of threshold effects in the CSR–affordability nexus, quantifying the “minimum effective scale” for each CSR dimension (0.10–0.42). This advances threshold theory by demonstrating that CSR requires critical investment to generate non-trivial societal benefits, resolving inconsistencies in prior linear studies. The differential threshold patterns (U-shaped vs. inverted U-shaped) further enrich threshold theory by revealing that the direction of threshold effects depends on the nature of CSR dimensions (compliance-based vs. market-oriented).

5.2.3. Institutional Theory

The ownership heterogeneity results underscore the role of institutional context in shaping CSR outcomes. SOEs’ lower thresholds reflect institutional support (subsidies, land privileges), while POEs’ higher thresholds reflect market constraints—supporting the argument that CSR effectiveness is context-dependent in emerging economies. This finding extends institutional theory by highlighting how dual ownership structures in emerging markets shape the implementation and outcomes of corporate social responsibility.

5.2.4. Integration of Multiple Theories

This study integrates stakeholder theory, threshold theory, and institutional theory into a unified analytical framework:

Stakeholder theory explains what CSR dimensions affect affordability (e.g., tenant-oriented stakeholder CSR targets rental demand). Threshold theory clarifies when CSR

becomes effective (e.g., after crossing the cost–benefit break-even point). Institutional theory reveals why the effect varies (e.g., ownership-based differences in institutional support). This integration provides a more comprehensive explanation of the CSR–affordability nexus than single-theory frameworks, advancing the theoretical understanding of CSR’s societal impacts in emerging markets

5.3. Policy and Managerial Implications

5.3.1. Policy Implications

Threshold-guided differentiated incentives: based on the estimated thresholds, the government should implement incentive policies (rather than mandatory regulation) to guide enterprises to optimize CSR investment.

Targeted support for POEs: provide POEs with special subsidies for environmental and social CSR (e.g., land use discounts for affordable housing construction) to reduce their threshold for these dimensions, narrowing the gap with SOEs.

Pilot-first implementation: given spatial heterogeneity, threshold-guided incentives should first be piloted in 2–3 representative regions (e.g., first-tier cities with high housing stress and third-tier cities with balanced supply–demand) and promoted nationwide after optimizing based on pilot results.

Enhance transparency and supervision: require firms to report CSR–affordability linkages (e.g., number of affordable housing units supplied, regional distribution of housing supply) in annual CSR reports and establish a national database to enable stakeholder oversight.

Strengthen regional adaptation: adjust incentive intensity based on city tier—e.g., higher subsidies in high-price regions—to address spatial heterogeneity in housing markets.

5.3.2. Managerial Implications

(1) For state-owned enterprises (SOEs)

CSR portfolio optimization: Prioritize environmental and social CSR, allocating 35–40% of CSR budgets to these dimensions to reach thresholds (0.20 for CSR_SOC, 0.30 for CSR_ENV) efficiently. Align CSR investments with policy objectives (e.g., affordable housing construction, green building promotion) to leverage institutional support.

Threshold management: Use the calculated thresholds to guide resource allocation. For example, scale CSR_SOC to at least 0.20 to generate affordability gains, and avoid over-investing in stakeholder CSR (threshold 0.10 for RIA) to prevent operational inefficiency.

Collaborative CSR: partner with local governments to develop affordable housing complexes, leveraging policy subsidies and land privileges to reduce upfront costs and accelerate scale effects.

(2) For private enterprises (POEs)

CSR portfolio optimization: focus on economic and voluntary CSR, directing 40–45% of CSR resources to operational efficiency (CSR_ECO target: 0.25–0.29) and targeted innovation (CSR_VOL target: 0.20–0.27). Prioritize market-driven CSR practices that balance profitability and social value (e.g., low-cost construction technology R&D).

Threshold management: cap CSR_ECO at 0.29 to avoid quality degradation, and invest in voluntary CSR (threshold 0.27 for RIA) to capture niche markets (e.g., low-income rental housing).

Collaborative CSR: join green building alliances to share technology and procurement costs, reducing the threshold for environmental CSR (0.42 for HAI) and improving cost-effectiveness.

5.4. Limitations and Future Research

This study has five key limitations that offer directions for future research:

- (1) **Sample scope:** The sample focuses on listed real estate firms, excluding unlisted small and medium-sized developers that dominate local rental markets. Future research should expand the sample to include these firms, as their CSR practices may differ due to limited resources and regulatory oversight.
- (2) **Data dependence:** We rely on secondary data (e.g., iFinD database, annual reports) for CSR and affordability measurement, which may have potential measurement errors (e.g., incomplete CSR disclosure). Future studies could use primary data (e.g., surveys of enterprises and residents) to measure CSR and affordability more accurately.
- (3) **Endogeneity concerns:** despite using System-GMM to mitigate endogeneity, structural endogeneity may remain—CSR and housing affordability could be jointly influenced by unobserved factors (e.g., local government policy intensity, regional cultural values). Future research could adopt instrumental variable methods (e.g., policy shocks as exogenous instruments) to address this issue.
- (4) **Moderating variables:** This study only considers ownership type as a moderating variable, ignoring other potential moderators such as city tier, enterprise size, and industry competition intensity. Future research could introduce these variables to explore the boundary conditions of CSR's threshold effects.
- (5) **CSR Decomposition:** We use aggregated CSR dimensions; future studies could decompose CSR into specific practices (e.g., green building vs. waste management for environmental CSR) to identify key drivers of affordability. Mediation analysis (e.g., cost reduction, policy subsidies as mediators) could further unpack the causal pathways.
- (6) **Sample period:** The 2018–2023 sample period is relatively short. Longer panels (10+ years) could capture the cumulative impact of CSR, as environmental and social investments often have 5–10 year payback periods. Future research could also explore how macroeconomic shocks (e.g., COVID-19, policy shifts) moderate the CSR–affordability nexus.

6. Conclusions

This study systematically investigates the impacts of multidimensional corporate social responsibility (CSR) on housing affordability in China's real estate sector, utilizing dynamic panel data from 87 A-share-listed real estate firms spanning 2018–2023 and employing the System-GMM estimation method. By decomposing CSR into five distinct dimensions (environmental, social, economic, stakeholder, and voluntary) and measuring housing affordability through both the housing affordability index (HAI) and the rental affordability index (RIA), this research addresses critical gaps in existing literature and yields robust, data-supported conclusions that align with theoretical expectations and empirical evidence.

First, the findings confirm the heterogeneous nonlinear threshold effects of different CSR dimensions on housing affordability, validating the core research hypotheses. Environmental CSR (CSR_ENV) and social CSR (CSR_SOC) exhibit consistent U-shaped relationships with both the HAI and the RIA, with threshold values ranging from 0.22 to 0.35. As predicted by threshold theory (Hakimi et al., 2023) [5], initial investments in these dimensions—such as green building material procurement and affordable housing land acquisition—increase short-term operational costs (marginal cost > marginal revenue), thereby inhibiting affordability. However, once investments cross the critical threshold, economies of scale (e.g., bulk purchasing of green materials, centralized construction of affordable housing) and policy dividends (e.g., environmental subsidies, land preferences) drive marginal revenue to exceed marginal cost, leading to significant improvements in

affordability. For instance, CSR_ENV's threshold for the HAI is 0.35, and enterprises exceeding this value witness a 0.32-unit increase in the HAI, while CSR_SOC's threshold of 0.23 for RIA translates to a 5.3% reduction in average rental prices for state-owned enterprises (SOEs) post-threshold.

In contrast, economic CSR (CSR_ECO), stakeholder CSR (CSR_STA), and voluntary CSR (CSR_VOL) demonstrate inverted U-shaped threshold effects, with thresholds between 0.10 and 0.32. Moderate engagement in these dimensions optimizes resource allocation: CSR_ECO (e.g., fair pricing, stable employment) reduces construction costs to enhance the HAI; CSR_STA (e.g., tenant support services) alleviates rental burdens; and CSR_VOL (e.g., low-cost construction technology R&D) contributes to both purchase and rental affordability. However, overinvestment leads to diminishing returns—excessive economic CSR may compromise housing quality, overly generous stakeholder subsidies increase operational burdens, and symbolic voluntary donations divert resources from core business—consistent with the cost–benefit dynamic proposed in stakeholder theory (Freeman, 1984) [25]. Notably, CSR_STA's threshold effect is significant only for the RIA (threshold = 0.13) but not for the HAI, as its tenant-oriented practices directly address rental demand rather than high-value housing purchase decisions, validating Hypothesis H4.

Second, ownership type exerts a significant moderating role in the CSR–affordability nexus, reflecting China's unique institutional context of dual ownership structure. SOEs, as policy implementers, benefit from lower thresholds for environmental and social CSR: CSR_ENV's threshold for RIA is 0.27 for SOEs versus 0.38 for private enterprises (POEs), and CSR_SOC's threshold for HAI is 0.20 for SOEs compared to 0.28 for POEs. This is attributed to SOEs' preferential access to government subsidies, land privileges, and policy support, which mitigate upfront investment costs. In contrast, POEs—driven by market competition and profitability—exhibit more pronounced effects in economic and voluntary CSR: CSR_ECO's inverted U-shaped threshold for the HAI is 0.29 for POEs (lower than the full-sample 0.32), and voluntary CSR delivers a significant positive linear effect ($\beta = 0.29^*$, $p < 0.1$) for POEs, as market-oriented innovations (e.g., prefabricated construction R&D) directly reduce production costs. These findings underscore the importance of institutional context in shaping CSR effectiveness, extending institutional theory to emerging market CSR research.

Third, the linear impact analysis complements the threshold effects by revealing dimension-specific associations: environmental and social CSR are robustly positively correlated with both the HAI and RIA; economic CSR correlates positively with the HAI but not RIA; and stakeholder CSR correlates strongly with RIA but insignificantly with the HAI. These results align with Dahlsrud's (2008) [6] five-dimensional CSR framework, confirming that each dimension operates through distinct mechanisms—compliance-driven (environmental, social), operationally integrated (economic, stakeholder), and supplementary (voluntary)—to shape affordability outcomes.

The theoretical contributions of this study are threefold. First, it extends stakeholder theory by linking multidimensional CSR to housing affordability, a critical societal welfare indicator, bridging micro corporate decisions and macro livelihood improvement. Second, it advances threshold theory by quantifying the “minimum effective scale” for each CSR dimension and distinguishing between U-shaped (compliance-based) and inverted U-shaped (market-oriented) threshold patterns, resolving inconsistencies in prior linear studies. Third, it enriches institutional theory by demonstrating how dual ownership structures in China's real estate sector moderate CSR thresholds and effects, providing localized empirical evidence for emerging market CSR research.

From a practical perspective, the findings offer targeted implications for policymakers and enterprises. For governments, the identified thresholds (e.g., 0.23 for CSR_SOC and

0.32 for CSR_ECO) provide a quantitative basis for designing differentiated incentive policies—such as land discounts for POEs investing in affordable housing and green finance subsidies for environmental CSR—to guide enterprises toward optimal CSR allocation. For SOEs, prioritizing environmental and social CSR (35–40% of CSR budgets) to reach thresholds efficiently aligns with policy objectives and leverages institutional support. For POEs, focusing on economic and voluntary CSR (40–45% of resources) balances profitability and social value, avoiding overinvestment beyond critical thresholds.

This study is not without limitations. The sample is restricted to listed firms, excluding unlisted small and medium-sized developers that dominate local rental markets; secondary data may contain measurement errors; and unobserved factors (e.g., local policy intensity) could introduce residual endogeneity. Future research should expand the sample to include unlisted firms, use primary survey data for more accurate measurement, adopt instrumental variable methods to address endogeneity, and explore additional moderators (e.g., city tier, industry competition). Decomposing CSR into specific practices (e.g., green building vs. waste management) and conducting mediation analysis (e.g., cost reduction, policy subsidies as mediators) could further unpack causal pathways.

In conclusion, this study provides comprehensive evidence that multidimensional CSR exerts nonlinear, ownership-heterogeneous effects on housing affordability in China's real estate sector. The identified thresholds, dimension-specific mechanisms, and institutional moderators offer a roadmap for policymakers to promote targeted regulation and for enterprises to optimize CSR strategies, contributing to improved housing affordability and sustainable urban development, in line with China's "housing is for living in, not for speculation" policy orientation.

Author Contributions: Y.W.: conceptualization, methodology, formal analysis, writing—original draft. T.A.M.: supervision, writing—review and editing, funding acquisition. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data used in this study are available from the iFinD database and the National Bureau of Statistics of China. Restrictions apply to the availability of these data, which were used under license for the current study. Data can be requested from the corresponding author with permission from the data providers.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. Meng, B.; Zang, Q.; Li, G. Study on the impact of corporate social responsibility on carbon performance in the background of carbon peaking and carbon neutrality. *Bus. Ethics Environ. Responsib.* **2023**, *33*, 416–430. [[CrossRef](#)]
2. AL-Akheli, A.; Tan, H.; Hazaea, S.A.; ELfarra, B.; Al-Zubairi, A. Mapping the Literature Trends of Corporate Social Responsibility and Cost of Capital: A Systematic Literature Review. *Corp. Soc. Responsib. Environ. Manag.* **2025**, *32*, 3383–3407. [[CrossRef](#)]
3. Arellano, M.; Bond, S. Some tests of specification for panel data: Monte Carlo Evidence and an application to employment equations. *Rev. Econ. Stud.* **1991**, *58*, 277–297. [[CrossRef](#)]
4. Dao, V.-T.; Phung, M.-T.; Cheng, H. The Relationship Between Corporate Social Responsibility and Corporate Financial Performance: A Moderating Effect of Economic Policy Uncertainty. *Int. J. Financ. Res.* **2020**, *11*, 304. [[CrossRef](#)]
5. Hakimi, A.; Boussaada, R.; Karmani, M. Corporate social responsibility and firm performance: A threshold analysis of European firms. *Eur. J. Manag. Bus. Econ.* **2023**, *34*, 282–299. [[CrossRef](#)]
6. Dahlsrud, A. How corporate social responsibility is defined: An analysis of 37 definitions. *Corp. Soc. Responsib. Environ. Manag.* **2008**, *15*, 1–13. [[CrossRef](#)]
7. Barney, J. Firm Resources and Sustained Competitive Advantage. *J. Manag.* **1991**, *17*, 99–120. [[CrossRef](#)]

8. Chakraborty, A.; Gao, L.S.; Musa, P. Corporate social responsibility and litigation risk: Evidence from securities class action lawsuits. *Account. Financ.* **2023**, *63*, 1785–1819. [\[CrossRef\]](#)
9. Conway, L.; Khoo, J. The role of commercial real estate in shaping our carbon future. *Corp. Real Estate J.* **2023**, *12*, 131. [\[CrossRef\]](#)
10. Bibi, R.; Sumaira, S. The effect of financial development on economic Growth: Evidence from south Asian developing countries. *J. Environ. Sci. Econ.* **2022**, *1*, 1–17. [\[CrossRef\]](#)
11. Dahiyat, A. Does liquidity and solvency affect banks profitability? Evidence from listed banks in Jordan. *Int. J. Acad. Res. Account. Financ. Manag. Sci.* **2016**, *6*, 35–40. [\[CrossRef\]](#) [\[PubMed\]](#)
12. Hasibuan, D.H.M.; Hilary, V. Does corporate social responsibility enhance the impact of financial performance on firm value? *J. Econ. Financ. Manag. Stud.* **2024**, *7*, 4139–4147. [\[CrossRef\]](#)
13. Healy, P.M.; Palepu, K.G. Information Asymmetry, Corporate Disclosure, and the Capital Markets: A Review of the Empirical Disclosure Literature. *J. Account. Econ.* **2001**, *31*, 405–440. [\[CrossRef\]](#)
14. Dai, J.; Lu, C.; Qi, J. Corporate Social Responsibility Disclosure and Stock Price Crash Risk: Evidence from China. *Sustainability* **2019**, *11*, 448. [\[CrossRef\]](#)
15. Ghosh, A. Do real estate loans reflect regional banking and economic conditions? *J. Financ. Econ. Policy* **2016**, *8*, 37–63. [\[CrossRef\]](#)
16. Hasan, F. Corporate social responsibility and agency cost: Evidence from the UK retail industry. *Int. J. Res. Financ. Manag.* **2021**, *4*, 105–115. [\[CrossRef\]](#)
17. Chandratreya, A. Corporate Social Responsibility and Financial Performance: A Meta-Analysis. *Preprint* **2024**. [\[CrossRef\]](#)
18. Gatti, L.; Seele, P.; Rademacher, L. Grey zone in- greenwash out. A review of greenwashing research and implications for the voluntary-mandatory transition of CSR. *Int. J. Corp. Soc. Responsib.* **2019**, *4*, 6. [\[CrossRef\]](#)
19. Eccles, R.G.; Ioannou, I.; Serafeim, G. The impact of corporate sustainability on organizational processes and performance. *Manag. Sci.* **2014**, *60*, 2835–2857. [\[CrossRef\]](#)
20. Eichholtz, P.; Kok, N.; Quigley, J.M. Doing Well by Doing Good? Green Office Buildings. *Am. Econ. Rev.* **2010**, *100*, 2492–2509. [\[CrossRef\]](#)
21. Emerson, F.; Cunha, M. The Relationship Between ESG and Financial Performance in Brazilian Companies. *Rev. Adm. UFSM* **2024**, *17*, e3.
22. Nuru, F.; Jumardi, J.; Saputra, R.; Wijaya, I.; Saranga, E. Corporate Social Responsibility and Financial Performance: A Meta-Analysis. *J. Acad. Sci.* **2024**, *1*, 363–372. [\[CrossRef\]](#)
23. Fitriana, R. The effect of EPS and dividend payout ratio on stock prices: A study of PSX listed non-financial firms. *Int. J. Bus. Adm. Stud.* **2022**, *8*, 82–90. [\[CrossRef\]](#)
24. Flammer, C.; Ioannou, I. Strategic management during the financial crisis: How firms adjust their strategic investments in response to credit market disruptions. *Strateg. Manag. J.* **2021**, *42*, 1275–1298. [\[CrossRef\]](#)
25. Freeman, R.E. *Strategic Management: A Stakeholder Approach*; Cambridge University Press: Cambridge, UK, 1984.
26. Fu, J.-Y. Customer concentration and corporate charitable donations: Evidence from China. *Manag. Decis. Econ.* **2023**, *44*, 545–561. [\[CrossRef\]](#)
27. Jiang, Z.; Krishnamurthy, A.; Lustig, H. *The Rest of the World's Dollar-Weighted Return on U.S. Treasuries*; Working Paper Series 30089; National Bureau of Economic Research: Cambridge, MA, USA, 2022.
28. Kakkar, S.; Kuril, S.; Singh, S.; Saha, S.; Dugar, A. The influence of remote work communication satisfaction and CSR association on employee alienation and job satisfaction: A moderated-mediation study. *Inf. Technol. People* **2023**, *36*, 1810–1834. [\[CrossRef\]](#)
29. Chi, L.H.D.; Hang, B.T.T. Corporate social responsibility expenditure and financial performance: A comparison of Vietnamese listed and unlisted banks. *Cogent Econ. Financ.* **2023**, *11*, 2203987. [\[CrossRef\]](#)
30. Naeem, N.; Khattak, S.H.; Awan, T. Enhancing Firm Performance through Corporate Social Responsibility: The Impact of Foreign Ownership in Pakistan's Non-Financial Sector. *Qlantic J. Soc. Sci.* **2025**, *6*, 76–85. [\[CrossRef\]](#)
31. Lian, Y.-M.; Chen, Y.-C.; Kao, B.-K.; Yeh, Y.-H. An empirical investigation of the relationship between financial measures and corporate social responsibility. *Financ. Forum* **2018**, *7*, 1–8. [\[CrossRef\]](#)
32. Naseem, M.A.; Lin, J.; Rehman, R.U.; Ahmad, M.I.; Ali, R. Moderating role of financial ratios in corporate social responsibility disclosure and firm value. *PLoS ONE* **2019**, *14*, e0215430. [\[CrossRef\]](#)
33. Arellano, M.; Bover, O. Another look at the instrumental variable estimation of error-components models. *J. Econom.* **1995**, *68*, 29–51. [\[CrossRef\]](#)

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.