International Review of Economics and Finance 99 (2025) 104068

Contents lists available at ScienceDirect

International Review of Economics and Finance

journal homepage: www.elsevier.com/locate/iref

Capitalizing on risk: How corporate financial flexibility, investment efficiency, and institutional ownership shape risk-taking dynamics

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ARTICLE INFO

Keywords:
Institutional ownership
Investment efficiency
Financial flexibility
Risk-taking

ABSTRACT

In this study, we test the influence of financial flexibility [FF] on corporate risk-taking [RT], a crucial aspect of firm strategy and performance. In the volatile financial landscape of emerging markets like China, understanding how FF affects risk behavior is essential. Using data from 3571 Chinese listed firms spanning 2014 to 2023, we address this gap by exploring how FF impacts RT and the moderating roles of investment efficiency [INE] and institutional ownership [INO]. Our study employs dynamic panel generalized method of moments [GMM] and a new bias-corrected method of moments to offer robust insights. We find a significant positive correlation between FF and RT. Additionally, IE and INO significantly moderate this relationship, with RT notably amplified when FF exceeds industry- and year-adjusted averages. Interestingly, during exceptional periods, such as the COVID-19 crisis, the impact of FF on RT becomes insignificant. This study offers novel insights into the role of FF, IO and INE in risk management and provides valuable policy recommendations for stakeholders navigating high-risk investments.

1. Introduction

In the current dynamic and volatile markets, understanding how corporate financial flexibility (FF) shapes risk-taking (RT) dynamics is increasingly critical. Firms are confronted with economic complexities, environmental uncertainties, and shifting regulatory landscapes, making the strategic management of financial resources essential. Strategic management determines a firm's ability to navigate challenges, seize opportunities, and sustain long-term growth and competitiveness (Chang & Wu, 2021; Mishra, 2024; Naseer

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https://doi.org/10.1016/j.iref.2025.104068
Received 22 March 2024; Received in revised form 12 September 2024; Accepted 15 March 2025
Available online 17 March 2025

et al., 2024; Tang & Chang, 2024). Therefore, the significance of this study lies in its potential to reveal how FF empowers firms to take calculated risks, driving innovation and ensuring resilience in an ever-changing business environment (Denis, 2011). The global financial crisis of 2007–2008, followed by the COVID-19 pandemic, emphasizes the critical need for businesses to manage FF adeptly and navigate risks in an ever evolving global economic landscape (Marchica & Mura, 2010). Given these challenges, it is especially timely and relevant to evaluate the role of FF in RT, as emphasized by Liu and Chang (2020). This paper explores the dynamic relationship between FF and RT, viewing FF as a strategic resource that goes beyond conventional financial management paradigms.

Historically, FF was perceived as a crucial determinant of the extent to which businesses are willing to embrace risk as highlighted by previous studies (Biddle et al., 2009; Myers, 2003; Opler et al., 1999). Past research has established that FF plays a pivotal role in strategic decision-making, influencing sustainability initiatives, as well as competitive advantages (Denis, 2011; Marchica & Mura, 2010). However, recent studies have expanded this notion, emphasizing the proactive utilization of financial resources during unforeseen events, such as the financial crisis of 2008 (Borio, 2014) and enterprise's capacity to adapt and mitigate environmental uncertainties (Xu & Hitt, 2020). The literature has identified FF is an important determinant of the degree of risk that businesses are willing to embrace, highlighting its crucial role in influencing corporate RT decisions (Gamba & Triantis, 2008). Furthermore, FF plays a pivotal role in strategic decision-making, influencing sustainability initiatives and competitive advantages. This shift in perspective highlights the dynamic nature of FF and its role beyond mere adaptation (Díez-Esteban et al., 2017; Liu & Chang, 2020; Naseer et al., 2024). Unused debt capacity, a manifestation of FF, serves as a vital resource that signifies a company's ability to generate funds (DeAngelo & DeAngelo, 2007). This reserve not only provides resilience against economic uncertainties, but also acts as a resource for fostering company expansion, boosting profits, and enabling decision-makers to maintain financial control amid substantial market fluctuations (Bagh, Hunjra, et al., 2024; Bagh, Khan, et al., 2024; DeAngelo & DeAngelo, 2007; Huang et al., 2023).

RT is crucial for adapting to market changes and enhancing competitiveness, is not solely dependent on managerial willingness, but is also constrained by a company's ability to secure funds (Almeida & Campello, 2007; Fazzari et al., 1987; Huang et al., 2023; Smieja et al., 2023). Although engaging in calculated RT is essential for businesses to adapt to market dynamics, enhance competitiveness, and explore opportunities to earn higher returns (Acharya et al., 2011; Cucculelli & Ermini, 2013; Low, 2009), managers often face challenges due to agency problems and financing constraints, hindering their willingness and ability to pursue profitable, yet inherently risky investment projects (John et al., 2008). RT serves as the foundation stone for the sustainable development of an organization. While it is acknowledged that some businesses may face failure due to the risks they undertake, understanding the factors influencing risk taking and its consequences on economic performance is a crucial concern within the domain of strategic management and long-term economic development.

Previous research has examined factors that determine RT, for example, management characteristics (Coles et al., 2006; Faccio et al., 2016), corporate governance (Acharya et al., 2011; Kini & Williams, 2012), institutional factors (Chen et al., 2013; López-Gamero & Molina-Azorín, 2016), external environmental factors, such as climate change risks faced by firms (Naseer et al., 2024), incentives for RT (Mishra, 2024) and Chief executive officers (CEOs) overconfidence (Tang & Chang, 2024). Previous studies have shown mixed results on how financial flexibility influences risk. RT, presents a puzzle, ranging from a positive correlation (Bancel & Mittoo, 2011) to a non-linear Chang and Wu (2021) [1] and negative Minh and Vinh (2022) ones. Despite the ongoing debate regarding the impact of FF on RT, the specific relationship between the two remains not adequately explored. As a result, the main goal of this study is to contribute to the extant literature by assessing how Chinese A-share listed companies' ability to take risks is affected by their FF.

Moreover, while a separate strand of literature sheds light on the moderating role of different mechanisms in the relationship between FF and RT, there exists a notable gap in terms of understanding the underlying mechanisms (Wu et al., 2023). In this context, few studies have provided evidence of the positive impact of investment efficiency (INE) on strengthening the effects of FF on RT. However, a deeper exploration into the specific strategies or practices that contribute to INE would provide more insights. While studies have provided useful insights on these questions, the importance of INE as a reinforcing element for FF remains less explored (Hu et al., 2023; Kopyrina et al., 2023; Liu & Wu, 2023; Panousi & Papanikolaou, 2012). In short, building on the background, there are compelling reasons to consider a potential mechanism in determining the connection between FF and RT. For instance, as companies utilize their FF for strategic decisions, the effectiveness in allocating resources to diverse investment opportunities emerges as a critical factor. A higher level of INE could serve as a moderator, shielding the positive bearing of FF on RT. It empowers companies to make well-informed and value-maximizing investment decisions. On the flip side, a decrease in INE could lead to ineffective allocation, potentially impeding the realization of benefits.

In addition, and from an external perspective, institutions play a role in overseeing corporate governance (Bushee, 1998; Schmidt & Fahlenbrach, 2017). Institutional ownership (INO) involves significant entities, like mutual funds and pension funds, holding a company's stock (Connelly et al., 2010), and compared to others, they access information promptly, influencing decisions and mitigating agency costs (Rashed et al., 2018). This ownership structure holds considerable sway over investment decisions, playing an essential role in shaping strategic choices and financial directions within the company.

[1] A recent study by Chang and Wu (2021) emphasizes the significance of an extended analysis period and the use of dynamic panel modelling. In our research, we adopt a two Stage dynamic panel Generalized Method of Moments approach, incorporating the lagged dependent variable. Additionally, we apply the newly introduced bias-corrected method of moments for linear dynamic panel data models proposed by Breitung et al. (2022). This method effectively addresses challenges, such as higher-order autoregressive dynamics, unbalanced panel datasets, and individual-specific heteroscedasticity in large panels with fixed time frameworks, thus enhancing the robustness of our study and mitigating endogeneity conflicts.

Previous research demonstrates a positive relationship between diversity, performance, and FF, but the exact mechanism connecting efficient FF to RT is not fully explained. We propose that institutional investors may influence this relationship. This prediction is based on several factors: First, their substantial ownership can affect decision-making processes. Second, high INO might function as a governance mechanism, aligning the company's interests with those of institutional investors. This alignment could strengthen (buffer) FF and RT linkage, as institutions may provide strategic guidance and support for initiatives capitalizing on FF. Understanding how diverse perspectives contribute to strategic capital allocation, thereby enhancing FF, would provide a more granular understanding that enhances the utilization of FF into effective RT decisions is crucial for organizations seeking to optimize their financial management practices. In summary, INE and institutional ownership could serve as lenses. Therefore, our third objective of the study is to examine the interactions between FF and RT.

To understand the context, Chinese firms provide an ideal setting for evaluating the dynamic linkages among INE, FF, INO and corporate RT due to several potential reasons. First, China's rapidly evolving economy and dynamic market conditions present a unique environment for studying corporate behavior. As a major global economy, China's firms encounter unique challenges and opportunities that can shed light on broader economic trends and implications as indicated by (Bagh et al., 2024; Huang et al., 2023). Second, China's regulatory landscape and corporate governance mechanisms have undergone significant transformations in recent years (Ma & Jin, 2016; Phan et al., 2021). Third, China's diverse and heterogeneous market environment offers a rich dataset for empirical analysis. We believe that understanding these contextual influences is crucial for policymakers and investors in navigating China's business landscape, holding significant implications for theory, practice, and policy.

In our empirical work, we address how FF and RT are interconnected, focusing on the moderating influences of INE and INO. We analyze the micro-data of 3571 listed non-financial companies in China's A-share market from 2014 to 2023. The generalized method of moments reveals a significant positive effect of FF on RT and this effect is significantly moderated by INE and INO. Furthermore, the quantile regression analysis demonstrates that FF has a significant impact on RT, particularly at the upper and median quantiles. We identify where RT is significantly enhanced only when FF surpasses average levels industry-and year-adjusted means of FF. We also observe that an insignificant impact of FF on RT during exceptional periods, such as the COVID-19 crisis, is crucial for decision-makers. We undertake several tests to ensure the stability of our findings, which show consistent results.

Our principal contribution is to examine the nexus between FF and RT using China's A-share listed firms, while previous studies provided anecdotal shreds of evidence about how FF influences RT and presents a puzzle, ranging from a positive correlation (Bancel & Mittoo, 2011), to a non-linear one (Chang and Wu (2021) and negative (Minh and Vinh (2022) ones. Second, we analyze how INE and INO moderate the relationship between FF and RT. While the link between corporate governance mechanisms and firm performance has been studied in various contexts, existing literature presents diverse perspectives on the relationship between these mechanisms and different aspects of corporate governance (Abdoush et al., 2022; Ali & Tauni, 2021; Alkaraan, 2023; Alkaraan et al., 2023).

Third, the market dynamics have undergone record disruptions due to the pandemic, underlining the standing of identifying how companies how businesses navigate FF and RT. Based on this analysis, our study also investigates whether the relationship between FF and RT has been reshaped during COVID-19. Fourth, this study contributes by exploring the effect of FF influences RT only when it reaches a substantial size, ignoring negligible FF. To examine this hypothesis, we introduce a dummy variable threshold based on the industry- and year-adjusted means of FF. This categorizes all samples into either the group with high or low FF. The firm heterogeneity analysis helps identify and distinguish between firms with different levels of FF, contributing to an understanding of how variations in FF may influence firm behavior and RT. Methodologically, to address endogeneity, we employed the Two Stage dynamic panel Generalized Method of Moments by incorporating the lagged dependent variable. In addition, this study applied (Breitung et al., 2022) newly introduced bias-corrected method of moments for linear dynamic panel data models, to tackle challenges like higher-order autoregressive dynamics, unbalanced panel datasets, and individual-specific heteroscedasticity in large panels with fixed time frameworks. Further, we employ three measures (Altman z score, volatility in the firm's operating return on assets, and return on average assets of risk taking) in our analysis. In addition, we perform multiple robustness checks to validate our main findings. Finally, this study's results offer valuable insights for corporate boards, investors, regulators, academics, and other stakeholders on how FF influences RT and how INE and INO moderate this effect in China's A-share firms.

Section [2] emphasizes the theoretical groundwork and the formulation of hypotheses. Section [3] covers the data and methodology. In Section [4] the empirical results are discussed, and [5] we present the conclusion of the study.

2. Theoretical foundation and hypotheses development

This section outlines the theoretical foundation for studying financial flexibility [FF] and corporate risk-taking [RT], focusing on how investment efficiency [INE] and institutional ownership [INO] moderate this relationship. It includes subsections on theoretical underpinnings, literature review, gap identification, hypotheses development, and the conceptual framework.

2.1. Theoretical framework

RT involves a firm's deliberate exposure to uncertainties to achieve strategic objectives, varying based on industry dynamics, corporate strategy, and risk appetite **(**Palmer & Wiseman, 1999**).** Rooted in foundational work by Black and Scholes (1974)**,** RT is recognized as a resource-intensive endeavor, requiring substantial commitment to high-uncertainty projects (Bowman, 1984; Bromiley, 1991). This engagement in uncertain activities carries the potential for both positive and negative outcomes, making it integral to strategic decision-making. Several factors influencing a firm's propensity for RT include FF, INE, and INO. The financial crisis highlighted FF role in leveraging unforeseen events, demonstrating that FF extends beyond mere access to financial resources; it also

aids firms in navigating and adapting to environmental changes (Islam et al., 2019). FF as crucial in determining the extent of risk firms are willing to take Biddle et al. (2009), while Chang and Wu (2022) identify unused debt capacity as a key aspect of FF, helping firms manage economic uncertainties.

FF plays a critical role in financial decision-making, contributing to maintaining debt capacity and future financing capabilities. It enhances an enterprise's competitiveness and solidifies its market position (Hunjra et al., 2024). RT is a key factor in strategic management, influencing firms' growth trajectories and long-term sustainability. While firms engage in RT to capitalize on growth opportunities, drive innovation, and enhance competitiveness, it also exposes them to potential losses, making RT a double-edged sword requiring careful management (Bagh et al., 2024). Liu and Chang (2020) argue that FF and RT are integral to strategic decision-making. Díez-Esteban et al. (2017) describe RT as the intentional exposure to uncertainties in pursuit of strategic goals, influenced by market conditions and competition. However, sustaining RT activities requires significant resource support, underscoring the importance of FF.

The connection between FF and corporate RT is complex and shaped by several theoretical perspectives, including agency theory, trade-off theory [TOT], pecking order theory [POT], and real options theory [ROT]. Agency theory, as proposed by Meckling and Jensen (1976), explores the conflicts between shareholders and managers, suggesting that weak corporate governance can lead to suboptimal investment decisions, thereby undermining FF and limiting strategic RT. TOT posits that firms balance the benefits of debt against the costs of financial distress (Kraus & Litzenberger, 1973). Firms with greater FF are better positioned to avoid financial distress and undertake risky projects, thereby enhancing growth potential.

POT suggests that firms prefer internal financing over external sources due to concerns about asymmetric information (Myers & Majluf, 1984). This internal FF supports a positive relationship between FF and RT, as firms can pursue risky projects without incurring the costs associated with external financing. ROT views investment decisions as strategic options that can be exercised under favorable conditions, with FF enabling firms to adapt to changing market dynamics, thereby reducing downside risk and enhancing upside potential (Trigeorgis & Reuer, 2017). These theories collectively provide a comprehensive framework for understanding how FF can enhance corporate RT while managing associated risks, emphasizing the critical role of FF in navigating investment decisions and strategic RT.

In this study, we integrate the agency theory, real options theory, and other relevant perspectives that form the base of this study. Agency theory provides critical insights into how FF influences RT by addressing conflicts between managers and shareholders (Meckling & Jensen, 1976). Real options theory, meanwhile, highlights how firms with greater FF are better positioned to seize growth opportunities and mitigate risks Hunjra et al. (2024); Leahy and Whited (1995). By linking these theories, this study explores how FF allows firms to manage agency problems more effectively, facilitating strategic decision-making in RT and innovation. The intersection of these theoretical perspectives accentuates the multifaceted role of FF in balancing risk and opportunity, ultimately contributing to sustained competitive advantage.

2.2. *Hypotheses development*

2.2.1. *Economic effect of financial flexibility on risk-taking*

Studies consistently emphasize the crucial role of FF in shaping strategic decisions and its impact on RT. RT involves intentionally exposing the firm to uncertainties to achieve strategic goals, with the degree of risk-taking influenced by the company's strategy and risk tolerance (Díez-Esteban et al., 2017). Effective RT often requires substantial resources, highlighting FF's critical role in enabling firms to take calculated risks (Liu & Chang, 2020). Since RT is resource-intensive, the resources a company is willing to commit to uncertain ventures reflect its risk approach (Chang & Wu, 2021; Kuo et al., 2021). However, FF presents a double-edged sword; while it empowers firms to capitalize on favorable conditions, it also introduces risks that need careful management (Bagh et al., 2024; Garmaise & Natividad, 2021). The relationship between FF and RT has been the subject of extensive research. For instance, Ma and Jin (2016) identified a positive correlation between FF and RT in China.

Conversely, Hunjra et al. (2024) highlighted a nonlinear relationship between FF and RT in Chinese listed firms. Langenmayr and Lester (2018) showed a direct correlation between taxation and risk propensity, further broadening the context of RT. In developing and emerging nations, FF has broader economic implications. Bilyay-Erdogan (2020) found that FF positively influences firm value across developing and emerging nations, underscoring FF broader economic implications. Bonaimé et al. (2014) emphasized that risk management and payout decisions critically shape a firm's financial flexibility. Chang and Wu (2021) discovered a U-shaped relationship between FF and RT during the COVID-19 pandemic among firms listed on the Taiwan Stock Exchange.

Despite extensive research, gaps persist, particularly in understanding the dynamic link between FF and RT in the unique context of China. China's distinctive institutional environment, with significant government intervention and unique corporate governance practices, may affect these dynamics in ways not fully understood. While existing empirical studies offer valuable insights, their methodological approaches vary—some use longitudinal data to capture FF dynamic nature, while others rely on cross-sectional analyses that may overlook temporal fluctuations. This study critically examines these approaches, providing a nuanced understanding of FF influence on RT. By addressing gaps in previous research, especially in emerging markets, this study contributes to the literature on how FF shapes RT.

Agency theory, which explores conflicts of interest between principals and agents, suggests that managers may exhibit varying degrees of risk-taking based on their level of FF. Under this theory, managers might prioritize personal interests over those of shareholders, potentially leading to suboptimal decisions regarding corporate investments and risk-taking activities (Bancel & Mittoo, 2011). Furthermore, the adaptive market hypothesis posits that financial markets and participants adjust to changing conditions, implying that the relationship between FF and RT may vary under different economic circumstances (Hunjra et al., 2024).

Considering these theories, we propose the 'Accelerate the Risk' hypothesis, implying a significant positive relationship between FF and RT. According to agency theory, managers with greater FF are more likely to engage in riskier projects due to the availability of resources that can cushion potential losses (Jensen, 2001). Real options theory supports this view by suggesting that FF enables firms to capitalize on growth opportunities and adapt to changing market conditions (Trigeorgis & Reuer, 2017). Empirical studies reinforce this perspective, showing that firms with higher FF tend to undertake more significant risk-taking initiatives due to their enhanced capacity to absorb and manage uncertainty (Almeida & Campello, 2007).

Based on these theoretical foundations, we hypothesize that firms with higher levels of FF will exhibit greater risk-taking behavior, as they possess the resources and flexibility to pursue opportunities and navigate uncertainties effectively. Thus, our first hypothesis is as follows:

H1. There is a positive significant relationship between financial flexibility and risk-taking.

2.3. The Moderating role of investment efficiency

Investment efficiency (INE) is crucial in determining how effectively companies allocate their resources, directly influencing their growth prospects and future cash flows. Prior research has explored the impact of INE on corporate risk, firm value, and overall performance, with mixed findings. For instance, Leahy and Whited (1995) found no significant correlation between INE and risk, while Baum et al. (2006) identified a positive correlation between uncertainty and INE. Conversely, Panousi and Papanikolaou (2012) reported a negative correlation between idiosyncratic risk and corporate INE. Raza et al. (2021) further explored the relationship between investment efficiency, investment scale, financial flexibility, and company performance in Pakistan, highlighting the influence of INE on corporate outcomes.

High INE reflects a firm's ability to effectively utilize its assets, serving as a key indicator of success (Chen et al., 2017). Companies can enhance their intangible asset capabilities by channeling resources into research and development [R&D] and other innovative avenues (Alkaraan, 2023; Radicic & Alkaraan). However, despite the acknowledged importance of INE, its role as a reinforcing factor for FF in the context of RT remains underexplored. Given the strategic importance of FF, particularly in environments marked by uncertainty, understanding how INE moderates the FF-RT relationship could provide valuable insights. Hu et al. (2023); Kopyrina et al. (2023); Liu and Wu (2023); Wu et al. (2023) argue that when companies leverage their FF for strategic decisions, the efficiency with which they allocate resources to various investment opportunities becomes paramount. A higher INE could amplify the positive effects of FF on RT, enabling firms to make well-informed, value-maximizing investment decisions. Conversely, a decline in INE might lead to ineffective resource allocation, hindering the potential benefits of FF. In short, exploring the moderating effect of INE on the FF-RT relationship can shed light on how firms can optimize their strategic risk-taking endeavors. This leads to our second hypothesis:

H2. There is a significant moderating role of INE in the relationship between FF and RT.

The "Smooth the Path" hypothesis proposes examining the moderating role of INE in the FF-RT relationship. Besides, Resource-Based Theory suggests that efficient resource utilization, including financial flexibility, is essential for maximizing firm performance and strategic outcomes (Barney, 1991). By enhancing INE, firms can better leverage their FF to pursue profitable and strategic risks. Agency theory also posits that INE reduces the likelihood of wasteful spending, enabling firms to channel their FF into high-return projects more effectively (Chen et al., 2017).

2.4. The Moderating role of institutional ownership

In addition to INE, institutional ownership (INO) plays a pivotal role in shaping corporate governance and mitigating agency costs, which directly impacts RT. INO, through its ability to influence board appointments and major corporate decisions, aligns management with shareholders' interests, leading to improved financial performance (Cheong et al., 2021; Kabir et al., 2020). Institutional owners, with their substantial stakes and resources, are better positioned than individual shareholders to monitor management and reduce agency conflicts (Lin & Fu, 2017). This oversight can lead to better decision-making, particularly regarding investment strategies, as indicated by studies like those of (Bose et al., 2018; Bushee, 1998; Connelly et al., 2010; Rashid, 2020; Schmidt & Fahlenbrach, 2017).

The "Fine-Tune the Controls" hypothesis explores the moderating role of INO in the FF-RT relationship. Stewardship Theory suggests that institutional ownership can align managerial goals with those of shareholders, reducing agency conflicts and enhancing decision-making (Aluchna et al., 2022; Wang et al.)(Wang & Luo, 2024). Conversely, Agency Theory highlights that institutional investors might influence managers' risk-taking behavior by providing oversight and governance, which can either mitigate or enhance risk-taking depending on their monitoring intensity and investment horizon (Shleifer & Vishny, 1997). Empirical research suggests that institutional ownership often affects how financial flexibility translates into risk-taking, with higher levels of INO potentially moderating this relationship in complex ways.

Gillan and Starks (2003) propose that the rise in institutional investors has facilitated the improved surveillance of managerial behavior. The following studies (Ali & Tauni, 2021; Alkaraan, 2023) suggest that ownership structures, particularly institutional ownership could play a pivotal role in influencing managerial risk-taking incentives. Specifically, the impact of FF on RT may be stronger in firms with higher levels of institutional ownership, as these investors are likely to support and guide strategic risk-taking efforts. Conversely, in firms with lower levels of institutional ownership, the influence of FF on RT may be less pronounced, as the lack of strong external monitoring might lead to either excessive risk-taking or overly conservative strategies. Thus, the third hypothesis of

this study is formulated as follows:

H3. Institutional ownership moderates the relationship between FF and RT, with higher institutional ownership strengthening this relationship.

Considering the current institutional landscape, as China transitions from high-speed growth to high-quality development, understanding how companies manage FF and RT becomes pivotal. We aim to fill the gap in the literature by exploring the impact of FF on corporate risk-taking in the specific setting of China. This research not only contributes insights into FF and RT, but also sheds light on the moderating roles of INE and INO. Fig. 1 illustrates the conceptual framework, which acts as the theoretical foundation of our investigation.

3. Data and methodology

3.1. Data and sample construction

The study dataset comprises of 3571 non-financial firms listed on China's A-share market from 2014 to 2023, with data sourced primarily from S&P Capital IQ Financials[2] and the China Stock Market & Accounting Research Database. Economic indicators were obtained from the World Bank database. The sample was constructed using several criteria to ensure reliability and homogeneity. This study included only A-share listed firms, excluding those with negative equity or incomplete information, and focusing on firms that provided industry segment data at the four-digit SIC code level. Additionally, "financial and utility" firms were excluded owing to their distinct capital structures & regulatory environments, which could introduce bias and heterogeneity into the analysis (Fama & French, 1992). Financial firms, such as banks and insurance companies, are subject to stringent regulations and high leverage, while utility companies operate under stable but atypical financial patterns (Chang et al., 2015). To ensure sample homogeneity and reliability, the study excludes financial and utility companies due to their distinct financial characteristics and regulatory environments (Lee et al., 2018). This exclusion aligns with existing literature and focuses the findings on non-financial firms (Hossain & Masum, 2022). To further enhance data integrity, outliers were removed, and variables were winsorized at the 1st and 99th percentiles to minimize the impact of extreme values.

3.2. Variables

In our analysis, we employ three distinct measures of risk-taking [RT] to ensure a comprehensive evaluation (Cao et al., 2021; Gamba & Triantis, 2008). The primary metric used is the Z score, calculated as shown in Equation (1):

We employ three measures of RT in our analysis (Cao et al., 2021; Gamba & Triantis, 2008). In our primary analysis, we rely on the *Z* score as the key metric as calculated in Equation (1).

$$RT_{i,t} = \left(ROA_{i,t} + ETA_{i,t}\right) \div \sigma ROA_{i,t} \quad [1]$$

Here $ROA_{i,t}$ represents return on assets for firm i at time t and it provides a measure of a company's profitability concerning its total assets. $ETA_{i,t}$ typically refers to earnings before interest, taxes, and amortization while $\sigma ROA_{i,t}$ denotes the standard deviation (volatility) of the ROA for firm *i* at time *t*. It measures the degree of variation or risk in the firm's operating performance.

To enhance the robustness of our evaluations, we incorporate two supplementary metrics for measuring RT that assess the level of risk associated with outcomes. The second measure,[3] referred to as σ(ROA), quantifies the volatility in the firm's operating return on assets and this proxy is widely used in financial economics literature. The third proxy for RT is Return on Average Assets (ROAA), in line with the approach used by past studies (Chen et al., 2015; Minh & Vinh, 2022; Vo, 2018).

The computation of financial flexibility (FF) involves two components: Cash Flexibility (CF) and Debt Flexibility (DF). Cash Flexibility (CF) evaluates the company's capability to leverage internal funds and is derived as CF = (Cash + Cash Equivalents)/Total Assets. On the other hand, Debt Flexibility (DF) gauges the firm's access to external financial resources and is determined as 1 minus the corporate debt ratio as employed by (Hunjra et al., 2024) and calculated by using Equation (2).

$$FF = Cash\ flexibility\ (CF) + Debt\ flexibility\ (DF) \quad [2]$$

The study utilized corporate investment efficiency (INE) and institutional ownership (INO) as moderators of the relationship between RT and FF. Recent literature (Biddle et al. (2009); Chen et al. (2011) indicates that measures for INE are useful for the following reasons. (a) The latest measures for INE. (b) the measure captures maximum categories of investment, and (c) evaluates both the aspects of growth and the possibilities for investment as indicated by (Ullah et al., 2021). We employed the latest two measures for INE (Biddle et al., 2009), first measures INE model is calculated using Equation (3).

$$INV_{i,t+1} = \alpha_0 + \beta_1 \text{Sales Growth of the firm}_{i,t} + \varepsilon_{i+t} \quad [3]$$

[2] Nearly all data spans from 2013 to 2023 and ownership structures typically exhibit stability, the fact that the firm-level data are from the same year is not a significant concern.

[3] Reflects the riskiness of investment decisions, focusing specifically on the volatility of accounting returns rather than stock market returns.

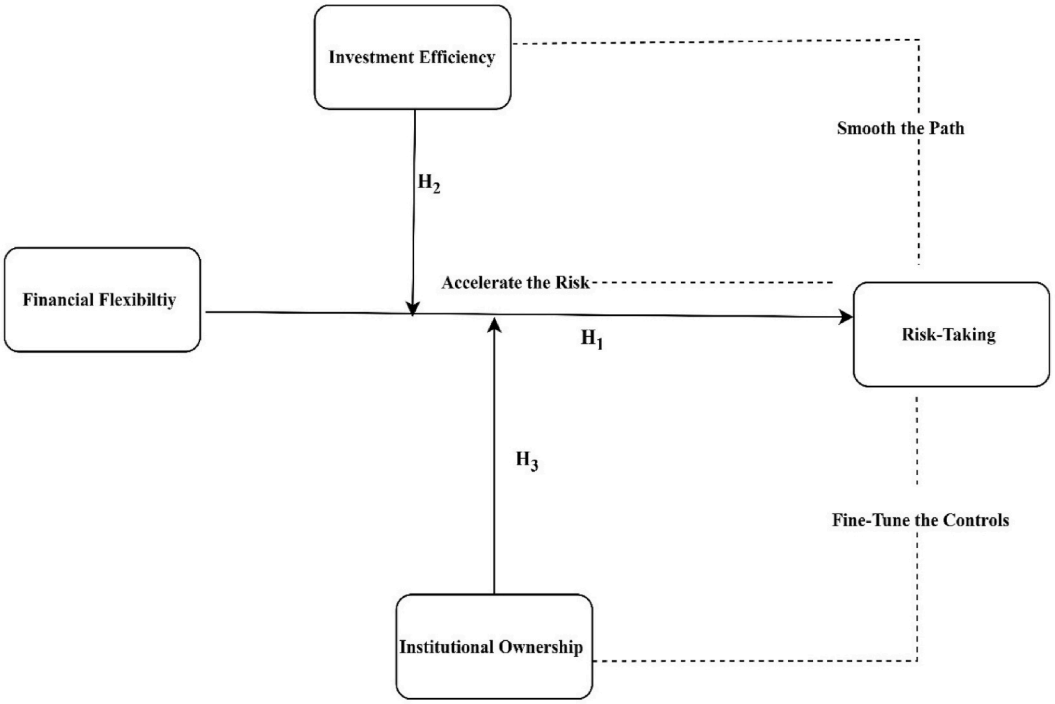

Fig. 1. Conceptual framework.

In equation (3), investment $INV_{i,t+1}$ reflects total industry-year group investment, and sales growth $Sales\ Growth_{i,t}$, serves as a proxy for investment opportunities, representing the percentage change in sales within each industry-year group from year *t-1* to *t*. Cross-sectional estimation is conducted for each year and industry, with residuals indicating deviations from the expected level. A positive residual indicates overinvestment (going beyond the expected level concerning sales growth), while a negative residual suggests underinvestment (falling below the expected level). Consequently, the test variable INE,[4] representing the absolute value of residuals multiplied by −1 and treated as the dependent variable, reflects efficient investment.

For robustness, we employ equation (4) the model proposed by Chen et al. (2011) to assess investment efficiency as a second measure:

$$\mathrm{INV}_{i,t} = \alpha_0 + \beta_1 \mathrm{NEG}_{i,(t-1)} + \text{Sales Growth}_{\ i,t} + +\beta_3 \mathrm{NEG}_{i,(t-1)} \times \text{Sales Growth}_{\ i,t-1} + \varepsilon_{i+t} \quad [4]$$

In this context, $\mathrm{INE}_{I,t}$ represents the total investment of firm i in year t, calculated as the net increase in both tangible and intangible assets, scaled by lagged total assets. Lagged Sales Growth *i, t−1* denotes the previous period's sales growth, and the negative sales growth indicator is a variable set to one if the sales growth is negative for the firm and zero otherwise.

Institutional ownership [INO] is quantified as the proportion of shares owned by an institutional investor at a given time. INO provides insight into the extent to which institutional investors, such as insurance funds, mutual funds, security funds, and other large financial institutions, collectively hold ownership stakes in a given firm (Alqatamin et al., 2017; Andrieş et al., 2023). Furthermore, as per the prevailing literature, we incorporate both firm and macroeconomic variables to address and consider these influences. This article includes the following control variables*: Institutional ownership, Firm Size, Firm leverage, Asset Tangibility, Investment scale, Herfindahl-Hirschman Index, Inflation*, and *Gross Domestic Product* (Chang & Wu, 2022; Dong et al., 2017; Phan et al., 2021; Tran, 2020). The variables detail is presented in Appendix Table A1.

3.3. Econometric models setting and empirical approach

In our study, we test three baseline hypotheses using econometric models [e.g., 5–7]: (1) "*Accelerate the risk*": This hypothesis posits a significant positive relationship between financial flexibility (FF) and risk-taking (RT). (2) "*Smooth the path*": This hypothesis explores the moderating role of investment efficiency (INE) in the FF-RT relationship. (3) "*Fine-tune the controls*": This hypothesis examines the moderating role of institutional ownership (INO) in the FF-RT relationship.

[4] We employed two metrics to gauge investment efficiency. The primary measure was based on equation (3) that is based on Biddle et al. (2009) model, while Equation (4) that is informed by Chen et al. (2011) model was utilized as a robustness check.

We begin our empirical analysis to test the effect of FF and RT and how this relationship is moderated by INE and INO by employing fixed effect regression.

$$RT_{i,t} = \alpha_0 + \beta_1 FF_{i,t} + Controls\ldots + \sum V_I IFE + \sum \eta_1 YFE + \varepsilon_{i,t} \quad [5]$$

$$RT_{i,t} = \alpha_0 + \beta_1 FF_{i,t} + \beta_2 INE_{i,t} + \beta_3 \left(FF_{i,t} \times INE_{i,t}\right) + Contls\ldots + \sum V_I IFE + \sum \eta_1 YFE + \varepsilon_{i,t} \quad [6]$$

$$RT_{i,t} = \alpha_0 + \beta_1 FF_{i,t} + + \beta_2 INO_{i,t} + \beta_3 \left(FF_{i,t} \times INO_{i,t}\right) + Contls\ldots + \sum V_I IFE + \sum \eta_1 Y\ FE + \varepsilon_{i,t} \quad [7]$$

The subscript [i] represents firms, while the subscript [t] represents time, where corporate Risk-Taking [RT], and Financial Flexibility [FF]. Additionally, Institutional Ownership [INO] and Investment Efficiency [INE] function as moderating variables. Meanwhile, Firm Size [FS], Leverage [LEV], Assets Tangibility [TANG], Investment scale [INVSCALE] Herfindahl-Hirschman Index (HHI), Inflation, and Gross Domestic Product [GDP] are considered firm and macro-level factors.

3.4. Addressing endogeneity in linear models

To address endogeneity, we employed the Two Stage Dynamic Panel Generalized Method of Moments (TSDP-GMM), as established by (Arellano & Bover, 1995) and used by recent studies (Bagh et al., 2024; Iftikhar et al., 2024; Naseer et al., 2024). This approach incorporates the lagged dependent variable, lagged dependent, to generate instrumental variables, mitigating endogeneity and reverse causality issues. Additionally, we used the newly introduced bias-corrected method of moments for linear dynamic panel data models (Breitung et al., 2022). This method effectively handles challenges such as higher-order autoregressive dynamics, unbalanced panels, and individual-specific heteroscedasticity in large datasets with fixed-time frameworks. With features like cluster-robust standard errors, it outperforms traditional GMM and maximum likelihood approaches, offering efficient and accurate estimation. To further ensure robustness, we incorporated alternative measurements and techniques throughout the analysis.

4. Empirical results and analysis

4.1. Descriptive statistics and correlation matrix

Table 2 provides summary statistics for the study's variables. RT, measured by the Altman *Z* score, has a mean of 1.958 and a standard deviation of 1.346, indicating moderate risk-taking with notable variability; the maximum value is 5.677. FF has a mean of 0.366 and a standard deviation of 0.454, reflecting moderate flexibility with variability; the maximum value is 2.973. INO shows a mean of 8.537 and a high standard deviation of 14.344, highlighting significant variability, with values ranging from 0.000 to 67.675. INE has a mean of 0.095 and a standard deviation of 0.504, with values spanning from 0.601 to 7.941. Next, we assessed the bivariate linear correlations among variables pairwise. Table 3 indicates that there are no multicollinearity issues, as all Variance Inflation Factor [VIF]values are below 10.

4.2. Baseline estimations

This study investigates the impact of FF on RT. To achieve the first objective, we utilize two baseline models: first, a fixed-effect model that incorporates robust standard errors to account for unobserved heterogeneity. Furthermore, we employ a Feasible Generalized Least Squares[5] (FGLS) model to address challenges like autocorrelation, heteroskedasticity, and cross-sectional dependence. The foundational findings are presented in Table 3, where Columns 1 and 2 indicate a significant positive association between financial flexibility and corporate risk-taking. These findings suggest that *FF* improves *RT* and lends support to our study main hypothesis H1.

Next, we investigate the moderation effect of *INE* and *INO* in shaping the relationship between *FF* and RT. Columns 3 to 6 present the moderation estimations: Columns 3 and 4 explore the role of *INE* as a moderator, while Columns 5 and 6 analyze the moderating impact of *INO* in shaping the *FF-RT* relationship. The findings of the study show that *INE* and *INO* play positive and significant roles in strengthening the relationship between FF and RT indicated as FF*INE and FF*INO in the given Table 4. The finding reveals that study supports the hypotheses H2 and H3. Additionally, it supports the argument that FF enhances the RT and shows that *INE* and *INO* strengthen the relationship between FF and RT. In addition, the study includes the firm characteristics and country specifications to provide more robust results for study across all empirical specifications. Among the control variables, we observe that RT is negatively affected by (FS), LEV, TANG), and Inflation, while *INVSCALE, HHI,* and *GDP* have a positive impact on RT. The inclusion of individual fixed effects serves to reinforce the internal validity of the results, maintaining a consistent affirmation of the positive impact of FF on RT.

[5] To address common statistical challenges, such as serial/autocorrelation, heteroskedasticity issues, and cross-sectional dependence.

Table 1
Descriptive statistics.

Variables	Obs.	Mean	SD	Min	p25	Median	p75	Max
RT	35,710	1.958	1.346	−0.423	0.787	1.987	3.238	5.677
FF	35,710	0.366	0.454	−2.011	0.457	0.803	1.05	2.973
INE	35,710	0.095	0.504	0.601	1.598	2.361	4.651	7.941
INO	35,710	8.537	14.344	0.000	0.261	2.322	10.716	67.675
FS	35,710	15.281	1.415	12.762	16.696	19.457	21.904	25.485
LEV	35,710	0.618	1.299	0.055	0.108	0.408	0.975	1.056
TANG	35,710	0.474	0.506	0.039	0.209	0.435	0.812	1.143
INVSCALE	35,710	0.049	0.0431	0.004	0.015	0.023	0.185	0.297
HHI	35,710	0.372	0.247	0.000	0.301	0.412	0.622	0.801
INF	35,710	2.279	1.522	−0.003	1.625	1.363	3.535	4.342
GDP	35,710	5.572	2.077	2.081	2.979	4.997	6.898	8.122

Notes: Table 1 presents the conventional statistical characteristics of the dataset, with corporate risk-taking (RT) and Financial Flexibility (FF). Furthermore, Institutional Ownership (INO) and Investment Efficiency (INE) serve as moderating factors. Furthermore, firm size (FS), leverage (LEV), assets tangibility (TANG), investment scale (NVSCALE), investment opportunities (Tobin's Q), Herfindahl-Hirschman Index (HHI), inflation, and gross domestic product (GDP) growth are seen as significant variables at both the firm and macro-level.

Table 2
Addressing multicollinearity concerns: Pearson correlations matrix and variance inflation factor (VIF).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) FF	1.000									
(2) INE	0.215**	1.000								
(3) INO	0.060**	0.201***	1.000							
(4) FS	−0.019	−0.133***	0.234**	1.000						
(5) LEV	−0.122**	0.141**	0.132**	−0.223***	1.000					
(6) TANG	−0.039	−0.101**	0.026	−0.150***	−0.129**	1.000				
(7) INVSCALE	0.563***	0.221**	−0.080***	0.115**	−0.101***	−0.067	1.000			
(8) HHI	−0.033	−0.114**	−0.113***	0.139**	−0.115**	0.025	0.131**	1.000		
(9) INF	−0.110**	−0.002	−0.108**	0.105**	−0.012	0.131**	0.032	0.120**	1.000	
(10) GDP	0.133**	−0.031	0.115**	0.603***	0.164***	−0.340***	0.142**	0.103**	−0.104**	1.000
VIF	1.997	1.584	1.146	1.597	1.311	1.998	1.542	1.732	1.791	1.091
1/VIF	0.501	0.631	0.873	0.626	0.763	0.501	0.649	0.577	0.558	0.917
Mean VIF	**1.579**									

Notes: Table 2 presents the correlations matrix provides insights into the interplay between exploratory variables, while the VIF assesses multicollinearity, ensuring robustness in the study models.

4.3. Main results two-step dynamic system GMM: endogeneity concern

To implement the Two Steps Dynamic System GMM, first, we conduct the Durbin and Wu–Hausman test to detect potential endogeneity. The Durbin and Wu–Hausman test outcome indicates that the Chi 2 statistic *p*-values are significant in all models' specifications. Since the p-value is less than 0.05, there is endogeneity. To deal with potential endogeneity we TSDP-GMM. Table 4 reports the estimation results for TSDP-GMM with the advantage of addressing the endogeneity by examining the direct and moderating effects. Column 1 reports the direct impact of FF on RT, next columns 2 and 3 report the moderating role of *INE* and *INO*, respectively. The study findings are unchanged and in line with recent literature. Among the control variables, we observe that RT is negatively affected by *FS, LEV, TANG,* and *INF*, while *INVSCALE, HHI*, and *GDP* have a positive impact on RT. Hansen test p-values suggest that our instruments maintain orthogonality conditions, indicating potential validity. Furthermore, the statistical insignificance of the AR (2) test is utilized to examine second-order residual autocorrelation, and coefficient supporting the idea that immediate past values are sufficient for prediction. The Sargan and Hansen tests obtained p-values greater than 0.05 indicating that over-identification becomes irrelevant when establishing the legitimacy or validity of the instrument since there is no over-identification, signifying that the TSDP-GMM has been accurately specified. The consistency of these results emphasizes the robustness of our findings, indicating a sustained positive impact of FF on RT. Notably, *INE* and *INO* continue to significantly moderate this association, even after addressing endogeneity concerns and accounting for relevant variables.

4.4. Bias-Corrected Method of Moments Estimator

Table 5 presents the results of the Bias-Corrected Method of Moments estimation analyzing the impact of *FF* on *RT*. Column 1 presents the direct impact of *FF* on *RT*, whereas columns 2 and 3 report the moderation estimation. The bias-corrected model enhances the robustness and reliability of these findings by accounting for potential biases in the estimation process. The significant and positive impact of *FF* on RT, as well as the strengthened relationship through the moderation of *INE* and *INO*, remains consistent even after addressing potential biases. This suggests that the observed effects are not skewed by methodological biases, lending greater

Table 3
Baseline regression estimates.

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	RT	RT	RT	RT	RT	RT
FF	0.0098***	0.0076***	0.0087**	0.0064***	0.0061***	0.0048***
	(3.9214)	(3.7364)	(2.0039)	(3.9703)	(4.8921)	(4.4010)
INE			0.0064***	0.0053*		
			(3.2272)	(1.9500)		
FF*INE			0.0044**	0.0037***		
			(2.0057)	(3.1048)		
INO					0.0138**	0.0121*
					(2.0065)	(1.9400)
FF*INO					0.0111***	0.0102**
					(3.4488)	(2.2118)
FS	−0.1533***	−0.1163***	−0.1220***	−0.1155***	−0.1606***	−0.1155***
	(-3.091)	(-16.6474)	(-17.3738)	(-16.5285)	(-3.222)	(-14.8243)
LEV	−0.0514**	−0.0949***	−0.0953***	−0.0948***	−0.0518**	−0.0947***
	(-2.0236)	(-20.7314)	(-20.8486)	(-20.7343)	(-2.0373)	(-5.023)
TANG	−1.0602***	−1.0034***	−0.9986***	−1.003***	−1.0567***	−1.0021***
	(-8.432)	(-30.033)	(-29.9219)	(-30.0322)	(-8.4024)	(-28.7624)
INVSCALE	0.0002	0.0005*	0.0004	0.0005*	0.0002	0.0005
	(0.5081)	(1.7137)	(1.6316)	(1.7172)	(0.4948)	(1.4134)
HHI	0.0298	0.0185	0.0231	0.0220	−0.0281	0.0225
	(-0.3050)	(0.3222)	(0.4023)	(0.3835)	(-0.2872)	(0.4109)
INF	−0.0201***	−0.0718***	−0.0809***	−0.0715***	−0.0189***	−0.0713***
	(-7.9494)	(-24.0379)	(-24.9689)	(-23.9322)	(-7.4555)	(-23.6035)
GDP	0.0045***	0.0176***	0.0183***	0.0176***	0.0045***	0.0175***
	(2.8902)	(8.5598)	(8.9227)	(8.5522)	(2.9429)	(8.4041)
_cons	1.7705***	1.7876***	1.7586***	1.7815***	1.7622***	1.7853***
	(33.8193)	(63.1562)	(61.613)	(60.2131)	(43.7617)	(52.3864)
Year/Firm [Fixed effect]	Yes	–	Yes	–	Yes	–
Obs.	35,710	35,710	35,710	35,710	35,710	35,710
adj. R^2	0.091	–	0.153	–	0.126	–
Wald test [p-value]	0.030	0.003	0.001	0.000	0.000	0.012

Notes: Fixed Effect Robust and Feasible Generalized Least Square regression for Model 1 shows how financial flexibility (FF) affects corporate risk-taking (RT) in Table (3), columns (1), and (2). Investment efficiency (INE) moderates the FF-RT relationship in Model 2 columns (3) and (4). Institutional ownership (INO) moderates the FF-RT relationship in Model 3 columns (5) and (6). The variable regression t-values, adjusted for clustering standard errors, are in parentheses. *, **, and *** indicate 10%, 5%, and 1% significance.

confidence to the validity of the study's conclusions. The study results so far demonstrate a positive and significant effect of *FF* on *RT*, and this effect is positively moderated by both moderating channels. To enhance more understanding, we further explore the threshold effect, and heterogeneous subgroups, and conduct a sensitivity assessment.

4.5. Further analysis of heterogeneous subgroups

Given the foundational rationale that the impact of determinants on risk-taking may be shaped by the distinctive circumstances of the Covid-19 pandemic, marked by widespread decreases in both stock prices and overall performance. To test this hypothesis, we report Pre Covid 19 and post-COVID period analysis.

Table 6 shows that during the COVID-19 period, FF did not have a negligible effect on *RT*. This finding is consistent with what Teng, Chang, and Wu (2021) found: that the conventional relationship between these variables was disrupted by the exceptional circumstances caused by the pandemic. The fact that it didn't make a difference implies that the usual relationship between *FF* and *RT* was either broken or had less of an impact under the unusual and unpredictable circumstances brought up by COVID-19. These results suggest that there may be a cutoff point beyond which *FF* may have a detrimental effect on risk-taking, even though FF may typically have a beneficial effect on *RT*. The extraordinary circumstances of the COVID-19 era also show that the impact of this relationship may change depending on the economic climate.

4.6. Group regression (effect of high and low FF on RT)

Next, we examine the effect of high and low financial flexibility on risk-taking. To investigate this hypothesis, we incorporate a binary variable (*THRSHLD*), determined based on industry- and year-adjusted means of financial flexibility. This variable classifies samples into two groups: those with higher FF (Threshold = 1) and those with less FF (Threshold = 0) and then we apply group regression. In Table 7 column 1 the results highlight the significant impact of FF on RT at Threshold = 1. Next, we observe how INE moderates the relationship between FF and RT at Threshold = 1. In Table 7 column 2 the results indicate INE moderates significantly moderates the relationship between FF and RT at Threshold = 1). Furthermore, in column 3, the results demonstrate the moderating effect of *INO* on the *FF* and *RT* relationship at Threshold = 1. In summary, Table 7 indicates that only when FF surpasses the average

Table 4
Dynamic generalized method of moments estimation: Addressing endogeneity.

Variables	(1)	(2)	(3)
	RT	RT	RT
L2. RT	0.0151***	0.0141***	0.0165***
	(3.4488)	(3.4488)	(3.4488)
FF	0.0061***	0.0058***	0.0051***
	(4.8921)	(4.4010)	(2.7047)
INE		0.0054**	
		(2.0002)	
FF*INE		0.0048***	
		(3.0017)	
INO			0.0117***
			(4.0065)
FF*INO			0.0101**
			(2.2018)
FS	−0.1606***	−0.1155***	−0.0979***
	(-3.222)	(-14.8243)	(-4.4236)
LEV	−0.0518**	−0.0947***	−0.1109
	(-2.0373)	(-5.0230)	(-1.298)
TANG	−1.0567***	−1.0021***	−0.902***
	(-8.4024)	(-28.7624)	(-8.7931)
INVSCALE	0.0025***	0.0011*	0.0031**
	(4.0381)	(1.9078)	(2.0608)
HHI	−0.0281	0.0225	0.0951
	(-0.2872)	(0.4109)	(0.7578)
INF	−0.01890***	−0.0713***	−0.0397***
	(-7.4555)	(-23.6035)	(-11.1174)
GDP	0.0045***	0.0175***	0.0134***
	(2.9429)	(8.4041)	(8.5246)
_cons	1.7622***	1.7853***	1.5632***
	(13.7617)	(52.3864)	(18.5325)
Year (Fixed effect)	Yes	Yes	Yes
Firm (Fixed effect)	Yes	Yes	Yes
No. of firms	3571	3571	3571
Sample period	2013–2023	2013–2023	2013–2023
AR (1) First Differences	0.000	0.000	0.000
AR (2) Second Differences	0.232	0.329	0.2513
Sargan test of overdid (Prob.)	0.313	0.431	0.324
Hansen test (Prob.)	0.129	0.510	0.822

Note: Table 4 presents the results for the impact of FF on RT in column (1). Columns (2 and 3) report the moderating role of INE and INO, The AR (1) first differences reveal a highly significant p-value of 0.000, emphasizing the impact of the initial lag in the autoregressive model. In contrast, the AR (2) second differences display a comparatively insignificant p-value, indicating reduced importance of the second lag. The Sargan test of overidentification affirms the validity of the instruments used. Furthermore, the Hansen test registers a p-value of 0.345, reinforcing the overall validity of the model. T-values are in parentheses, with ***p < .01, **p < .05, *p < .1.

level can they significantly improve *RT*. In summary, this supports the notion of a threshold effect while we observe insignificant effects at Threshold = 0.

4.7. Robustness check, and methodological strength

This research employed several robustness checks. In first robustness estimation, we apply the alternative estimator Driscoll-Kraay Standard Errors (DKSE) with Fixed Effects. In Table 8, the DKSE findings are consistent with our main analysis findings.

Secondly, we employ an alternative estimator known as the Panel-correct standard error method and utilize alternative regression techniques. Additionally, we consider alternative measures of RT, specifically defined as return on average assets[6] (ROAA) (Chen et al., 2015; Minh & Vinh, 2022; Vo, 2018), FF alternative measure cash holding ratio (Ma & Jin, 2016), and for INE equation (4) using Chen et al. (2011) INE model. In the Robustness check, we use alternative measures of RT defined as "return on average assets" (ROAA), FF alternative measure cash holding ratio, and INE equation (4). Additional controls include, enterprise scale is calculated as the natural logarithm of total assets+1 (Hao et al., 2022), investment opportunities are measured by Tobin's Q model (He et al., 2019), and innovation efficiency is determined as the natural logarithm of the number of invention patent applications plus[1](Hao et al., 2022). In Table 9, the panel-correct standard error findings with alternative measures remain unchanged.

[6] Derived from the ratio of earnings before interest and taxes to total assets, it serves as a well-acknowledged risk proxy in financial literature, emphasizing the volatility of accounting returns, not stock market returns (see, Faccio et al., 2016).

Table 5
Bias-corrected method of moments estimator.

Variables	(1)	(2)	(3)
	RT	RT	RT
L.RT	0.0252**	0.0146***	0.0195**
	(2.4488)	(4.4018)	(2.0088)
FF	0.0055***	0.0044**	0.0061**
	(4.0001)	(2.4003)	(2.0112)
INE		0.0044**	
		(2.1142)	
FF*INE		0.0032**	
		(2.1017)	
INO			0.0123***
			(3.0335)
FF*INO			0.0099***
			(4.3318)
FS	−0.0061**	−0.0039	−0.0081**
	(-2.1814)	(-1.0966)	(-2.0072)
LEV	−0.0359**	−0.0355*	−0.0508**
	(-2.0541)	(-1.9036)	(-2.4183)
TANG	−0.0047***	−0.0049***	−0.0041***
	(-4.6849)	(-4.7564)	(-4.6605)
INVSCALE	0.0022***	0.0033***	0.0023***
	(4.7724)	(5.846)	(5.7752)
HHI	0.0012**	0.0023	0.0028**
	(2.4188)	(1.1718)	(2.3901)
INF	−0.0040***	−0.0028***	−0.0035***
	(-8.9013)	(-11.1697)	(-8.7127)
GDP	0.0108***	0.0121*	0.0107***
	(7.9081)	(1.9041)	(3.4810)
_cons	2.7022***	3.7003***	11.5342***
	(10.7917)	(22.3004)	(12.0021)
Year (Fixed effect)	Yes	Yes	Yes
Firm (Fixed effect)	Yes	Yes	Yes
No. of ids.	3571	3571	3571
Sample period	2013–2023	2013–2023	2013–2023

Note: In Table 5, the results in column (1) present the outcomes of the Bias-Corrected Method of Moments Estimator by Breitung et al. (2022). T-values are in parentheses***p < .01, **p < .05, *p < .1.

Table 6
Sub Sample analysis considering sensitivity period.

Variables	Pre Covid 19		During COVID 19	
	(1)	(2)	(3)	(4)
	RT	RT	RT	RT
FF	0.0057***	0.0045***	0.0149	0.0133
	(3.6630)	(3.6665)	(1.3805)	(1.2230)
_Cons	2.4293***	2.3478***	2.4284***	2.4014***
	(7.651)	(7.2964)	(7.635)	(7.635)
Controls	–	Included	–	Included
Year fixed effect	Yes	Yes	Yes	Yes
Firm fixed effect	Yes	Yes	Yes	Yes
No. of firms	3571	3571	3571	3571
adj. R^2	0.0269	0.0302	0.0294	0.0294
F-Test [P-value]	0.000	0.000	0.000	0.000
Wald Test (Pre vs. During COVID-19)				0.710
Linear Combination t-Value				−0.844

Note: Table 6 presents an analysis of the impact of FF on RT: We focus on a sub-sample analysis considering a sensitivity period. The Wald test statistic of 0.710 and the linear combination t-value of −0.844 suggest that there is no statistically significant difference in the impact of FF on RT between the pre-COVID-19 and during COVID-19 periods. T-values are enclosed in parentheses.

Since the results of a linear regression equation are susceptible to being skewed by extreme outliers, we utilize the same method of estimating the conditional distribution of outcomes using the 50th, 75th, and 90th percentiles (Teng, Wang, et al., 2021). So, in our final validity check quintile regression analysis using a third proxy for RT is Return on Average Assets (ROAA), in line with the approach used by past studies (Chen et al., 2015; Minh & Vinh, 2022; Vo, 2018). Furthermore, to address the influence of extreme

Table 7
The threshold Effect of FF is determined based on industry- and year-adjusted mean.

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	FF > mean [Threshold = 1]			FF < mean [Threshold = 0]		
	RT	RT	RT	RT	RT	RT
FF	0.0105***	0.0095***	0.0169***	0.0059	0.0060	0.0102
	(0.0040)	(0.0045)	(0.00870)	(0.0042)	(045)	(0.0079)
INE		0.0092***			0.0047*	
		(0.0033)			(0.0027)	
FF*INE		0.0067***			0.0034	
		(0.0022)			(0.0022)	
INO			0.0144***			0.0105*
			(0.0043)			(0.0062)
FF*INO			0.0116*			0.0073
			(0.0049)			(0.0052)
_Cons	1.5206***	1.5180***	1.4632***	2.7102***	2.8915***	2.8757***
	(0.1517)	(0.0836)	(0.0838)	(0.2293)	(0.1859)	(0.1859)
Controls	Included	Included	Included	Included	Included	Included
Observations	21,213	21,213	21,213	13,826	13,826	13,826
R-squared	0.164	0.211	0.172	0.005	0.073	0.006

Note: Table 7 reports the threshold effect associated with financial flexibility. To investigate this hypothesis, we incorporate a binary variable (THRSHLD), determined based on industry- and year-adjusted means of financial flexibility. This variable classifies samples into two groups: those with higher FF (Threshold = 1) and those with less financial flexibility (Threshold = 0). This analysis features the impact of FF on RT. Robust standard errors are reported in parentheses; [***p < 0.01, **p < 0.05, *p < 0.1].

Table 8
Driscoll-kraay standard errors (DKSE) with fixed-effects.

Variables	(1)	(2)	(3)
	RT	RT	RT
FF	0.0066**	0.0052**	0.0045***
	(0.0033)	(0.0026)	(0.0022)
INE		0.0069***	
		(0.0028)	
FF*INE		0.0044*	
		(0.0026)	
INO			0.0113***
			(0.0049)
FF*INO			0.0080**
			(0.0040)
FS	−0.0023**	−0.0051***	−0.0033***
	(0.0013)	(0.0024)	(0.0015)
LEV	−0.0520**	−0.0523**	−0.0518**
	(0.0230)	(0.0229)	(0.0230)
TANG	−1.0262***	−1.0339***	−1.0274***
	(0.0616)	(0.0664)	(0.0618)
INVSCALE	−0.0002	−0.0002	−0.0002
	(0.0003)	(0.0003)	(0.0003)
HHI	0.0013***	0.0023**	0.0012***
	(0.0004)	(0.0013)	(0.0004)
LEV	0.0282	0.0229	0.0293
	(0.0710)	(0.0722)	(0.0714)
INF	−0.0203***	−0.0254*	−0.0204***
	(0.0067)	(0.0148)	(0.0067)
GDP	0.0044*	0.0051***	0.0045*
	(0.0026)	(0.0019)	(0.0026)
Constant	1.7305***	1.7008***	1.7227***
	(0.2729)	(0.2706)	(0.2739)
Observations	35,710	35,710	35,710
adj. R^2	0.091	0.141	0.161
F-test (Prob.)	0.000	0.000	0.000

Note: Within Table 8 column (1) presents the findings from the regression employing Driscoll-Kraay Standard Errors (DKSE) with Fixed Effects for Model 1, emphasizing the impact of FF on RT. Column (2) in Model 2 elucidates the moderating influence of INE on the FF and RT relationship, while Model 3, depicted in column (3), illustrates the moderating effect of INO.

Table 9
Robustness check, employing alternative regression techniques: Panel-correct standard error.

Variables	(1)	(2)	(3)
	RT	RT	RT
FF	0.0103***	0.0119***	0.0138***
	(3.1134)	(7.9401)	(3.2552)
INE		0.0091**	
		(2.1689)	
FF*INE		0.0061***	
		(3.8799)	
INO			0.0103***
			(2.8715)
FF*INO			0.0005*
			(1.9519)
_Cons	1.5523***	1.6596***	4.5325***
	(24.3067)	(41.1965)	(24.5491)
Controls	Included	Included	Included
No. of firms	3571	3571	3571

Note: Table 10 reports a robustness check, employing alternative regression techniques such as the panel-correct standard error and exploring various measures. The presented models examine the impact of financial flexibility (FF) on RT and the moderating effects of INE and INO. The assessment of FF involves the Cash Holding Ratio, INE employed by Chen et al.'s (2011) model, and RT is measured by Return on Average Assets (ROAA). Control variables include Enterprise Scale, Innovation Efficiency, and the Age of the firms. T-values are in parentheses ***p < .01, **p < .05, *p < .1.

outliers on linear regression results, the estimation of conditional distribution using percentiles was employed. Lastly, quintile regression analysis revealed a pronounced and significant effect of *FF* on *RT* at both the upper and median quantiles. Table 10 presents the results of quintile regression (QR) to demonstrate that *FF* has a pronounced more significant effect on RT at the upper and median quantiles. Overall, these rigorous checks enhance the confidence in the validity and reliability of the study's conclusions regarding the linkage between FF and RT.

4.8. Economics discussion and relevance

In this article, first, we examine the effect of FF on RT. The study findings demonstrate that FF has a significant effect on RT. Our study confirms a positive connection between FF and RT, consistent with theoretical expectations of existing studies (Chao & Huang, 2022; Langenmayr & Lester, 2018; Liu & Chang, 2020). Some potential reasons make FF an important determinant of RT. First, FF, mainly coming from internal cash and residual liability capacity, stands out as a key factor encouraging businesses to make efficient investment decisions. Second, FF, achieved through internal cash and remaining debt capacity, not only supports enterprise risk-taking but also opens the door to management favoring personal interests as indicated by (Liu & Chang, 2020). Additionally, INE and INO

Table 10
Quantile regression analysis using different regimes.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	90th	75th	50th	90th	75th	50th	90th	75th	50th
	RT	RTR	RT	RT	RT	RT	RT	RTR	RT
FF	0.0048***	0.0034**	0.0024*	0.0041***	0.0036**	0.0021*	0.0052**	0.0038**	0.0023*
	(0.0023)	(0.0017)	(0.0014)	(0.0016)	(0.0018)	(0.0012)	(0.0026)	(0.0019)	(0.0013)
INE				0.0051***	0.0037***	0.026**			
				(0.0024)	(0.0015)	(0.0013)			
FF*INE				0.0051***	0.0028**	0.0018**			
				(0.0022)	(0.00014)	(0.0009)			
INO							0.0092***	0.0064**	0.0020**
							(0.0032)	(0.0032)	(0.0010)
FF*INO							0.0054***	0.0023*	0.0016***
							(0.0020)	(0.0013)	(0.0008)
_Cons	2.1448***	2.6570***	3.5235***	2.1676***	2.5943***	3.3161***	2.1811***	2.5879***	3.3194***
	(0.0846)	(0.0853)	(0.0870)	(0.0635)	(0.0875)	(0.0670)	(0.0396)	(0.0666)	(0.0753)
Observations	35,710	35,710	35,710	35,710	35,710	35,710	35,710	35,710	35,710
No. of firms.	3571	3571	3571	3571	3571	3571	3571	3571	3571
Controls	Included	Included	Included	Included	Included	Included	Included	Included	Included
Psed_R^2	0.111	0.091	0.072	0.141	0.165	0.123	0.171	0.196	0.154

Note: Table 10 exhibits result from a dynamic panel quantile estimator that employs various regimes across different conditional distributions (90th, 75th, 50th). Standard errors are provided in parentheses at significance levels.

significantly moderate this association.

The study findings are aligned with fundamental financial theories. These findings are theoretically grounded in the concept that *FF* enables companies to seize opportunities and navigate uncertainties. This aligns with resource-based theories highlighting the strategic importance of financial capabilities.

Furthermore, the moderation effects of investment efficiency and institutional ownership are consistent with agency theory, which suggests that strong governance and efficient investments enhance the positive bearing of FF on RT. Agency theory, as articulated by Meckling and Jensen (1976), highlights the complex relationship between shareholders and managers, indicating that robust FF allows managers to make decisions that align with shareholder interests, thus fostering firm growth and stability. Additionally, in line with Barney (1991), resource-based view, the results demonstrate that a firm's internal resources, capabilities, and financial adaptability play a significant role in shaping its RT. Companies with greater investment efficiency and financial flexibility are better positioned to maneuver market uncertainties and capitalize on growth opportunities, aligning with the core principles of this theory.

In the context of FF, higher levels of FF allow firms to rely more on internal resources, providing them with the ability to adapt to changing circumstances and capitalize on opportunities. However, there may be a threshold beyond which the increased reliance on internal resources significantly influences risk-taking Behavior. Another theoretical perspective is the "adaptive market hypothesis," [AMH] which proposes that firms continuously adjust and refine their strategies to adapt to shifting market conditions and environmental changes (Hunjra et al., 2024). This hypothesis emphasizes the dynamic nature of market behavior, where firms evolve their approaches to maintain competitiveness and capitalize on emerging opportunities. The threshold effect observed in the study could be linked to firms adapting their RT based on the level of FF they possess. This adaptation may become more prominent when FF exceeds a specific threshold. Furthermore, our findings indicate that FF has a negligible (insignificant) impact on RT during COVID-19, and our results are consistent with (Teng, Chang, & Wu, 2021).

The AMH posits that financial markets and participants adapt to changing conditions, implying that the linkage between FF and RT, may vary during different economic circumstances (Bancel & Mittoo, 2011). In times of crises, such as the COVID-19 pandemic, firms and investors might alter their RT in response to heightened uncertainty and volatility. This theory posits that financial markets and participants adapt to changing conditions, implying that the relationship between financial variables, such as FF and RT, may vary during different economic circumstances. In times of crises, such as the COVID-19 pandemic, firms and investors might alter their RT in response to heightened uncertainty and volatility. Behavioral factors play a significant role in decision-making. During crises, behavioral biases such as risk aversion and loss aversion might dominate, influencing firms to be more conservative in their risk-taking, even in the presence of FF. Institutional ownership acts as an external perspective on the corporate governance structure. Investment efficiency, as an internal perspective on management, reflects how effectively a company utilizes its internal resources. In the context of FF and RT, INE moderates by influencing how well internal resources, made available through FF, are utilized for risk-taking decisions. A high level of investment efficiency implies that internal resources, driven by FF, are optimally deployed for strategic and risk-laden investments. On the other hand, lower investment efficiency may result in suboptimal use of available resources, potentially weakening the impact of FF on RT.

The interaction between INO magnifies the impact of FF on RT. Institutional ownership acts as an external perspective on the corporate governance structure. Higher levels of institutional ownership typically bring more oversight and influence from external entities. In the context of FF and RT, when institutional ownership is high, external stakeholders, such as institutional investors, actively participate in monitoring and influencing the decision-making process. This can either amplify or mitigate the impact of FF on RT, depending on the nature of the institutional investors. If they are actively engaged and supportive, FF might have a more pronounced effect on encouraging risk-taking. Conversely, if institutional investors are conservative or risk-averse, their oversight may temper the impact of FF on RT as indicated by (Schmidt & Fahlenbrach, 2017).

Additionally, investment efficiency acts as a reinforcing element for financial flexibility (Raza et al., 2021). In addition, Wu et al. (2023) highlight that the diversity within a firm's management team contributes to improved financial performance. Several factors are critical for determining a firm's financial performance. A strong corporate management mechanism ensures the optimal allocation of capital, channeling limited resources into projects with the highest return on investment. This strategic allocation enhances capital efficiency, maximizing returns and minimizing financial stress. By effectively managing capital, firms strengthen FF, positioning themselves to maintain financial stability in the face of economic uncertainties. In conclusion, the differing results may be attributed to contextual factors associated with corporate governance in non-financial firms in China's A-share markets. This study encourages further research into factors, such as institutional norms, cultural contexts, and regulatory environments to achieve a broader global understanding of how FF affects risk-taking.

5. Conclusion and policy insights

This study investigated the relationship between financial flexibility (FF) and risk-taking (RT), with a specific emphasis on how investment efficiency (INE) and institutional ownership (INO) act as moderating factors. Our analysis involved examining a dataset comprising 3571 listed firms, using micro-data for non-financial companies listed on China's A-share market spanning the years 2014–2023. The generalized method of moments reveals a significant positive effect of FF on RT. Additionally, INE and INO significantly moderate this association. Besides, quantile regression results highlight FF's significant impact on RT at upper and median quantiles, revealing its role as an enabler for calculated RT, exploring growth opportunities, and strategic positioning. We undertake several tests to ensure the stability of our findings, which show consistent results. The study draws on FF, INO, and INE as key variables influencing RT. The significance of these factors is rooted in financial theory, where FF reflects an organization's ability to adapt to changing circumstances, INO represents the governance structure influencing decision-making, and INE relates to the effective

utilization of resources.

The results of this study carry managerial and theoretical implications for corporate boardrooms, especially institutional investors, regulators, academics, and other stakeholders, shedding light on the effect of FF on RT, and how this effect is moderated by investment efficiency and institutional ownership within non-financial companies listed on China's A-share market.

First and foremost, decision-makers should prioritize evaluating a firm's FF when addressing risks. A substantial level of FF/unused debt capacity signifies resilience and the capability to navigate through challenges effectively. Conversely, low FF implies a sensitivity to potential exposures as our empirical work reveals that below-industry average mean values of FF have no meaningful effect on RT. Second, institutional ownership and investment efficiency are linked to enhanced financial flexibility and corporate risk-taking. Policymakers should consider enacting or reinforcing regulations that promote these practices, while also strengthening transparency, accountability, and board oversight to improve governance and financial decision-making. Third, policymakers and regulatory bodies of non-financial companies listed on China's A-share market might explore measures to incentivize or regulate institutional ownership practices, encouraging active participation in governance structures. The effectiveness of corporate governance mechanisms or policies is reflected in the improved FF and heightened RT exhibited by firms.

Fourth, recognizing the insignificant impact of FF on RT during exceptional periods, such as the COVID-19 crisis, is crucial for decision-makers. This highlights the need for adaptive risk management strategies that account for the potential breakdown of established correlations between FF and RT in unexpected situations. Policymakers should consider incorporating dynamic risk assessment frameworks that account for varying economic conditions, ensuring a more resilient approach to financial decision-making, particularly in times of unprecedented challenges like a pandemic. We believe this thoughtful perspective can guide the formulation of policies aimed at promoting optimal financial flexibility, creating a favorable environment for businesses to navigate risks and capitalize on strategic opportunities.

While the findings contribute valuable insights, certain limitations warrant consideration. The study focuses on non-financial companies listed on China's A-share markets necessitates caution in generalizing the results to other global contexts, highlighting the need for future cross-country comparative analyses. Additionally, the temporal scope and sample size, though substantial, may benefit from extended longitudinal studies to capture evolving dynamics over economic cycles. Future research avenues include industry-specific investigations, micro-level organizational analyses, and qualitative explorations of institutional ownership practices. These endeavors can offer a more nuanced understanding of the observed relationships. The use of static and dynamic panel-data methods, though robust, may be prone to biases and omitted variable issues, affecting result accuracy. The absence of an exogenous shock presents a challenge, as cross-sectional cuts in the study may not entirely establish causality. Additionally, considering external economic factors and regulatory effectiveness across emerging nations could reveal additional dimensions influencing financial decision-making and risk-taking behavior. Finally, the study suggests promising avenues for future research, one can explore the involved relationship between FF and sustainable innovation.

CRediT authorship contribution statement

Author 1: Conceptualization, Writing - original draft, Formal analysis, Methodology,
Author 2: Conceptualization, Data curation, Writing - original draft, Project administration,
Author 3: Conceptualization, Methodology, Project administration, Writing – review & editing,
Author 4: Conceptualization, Methodology, Project administration, Supervision, Writing - review & editing.

Appendix

Table A1
Variables description.

Variables	Variables measurement	Sources
Risk-Taking	Equation (1) to measure Corporate risk-taking (RT).	S&P Capital IQ Financials, China Stock Market, and Accounting Research.
Financial flexibility	Equation (2) to assess Financial Flexibility (FF).	
Investment efficiency	Equation (3) to calculate Investment Efficiency (INE).	
Institutional ownership	Institutional ownership (INO) refers to the percentage of a company's outstanding shares that are held by institutional investors, including mutual funds, pension funds, insurance companies, and other large financial organizations, at a specific point in time. This metric is important because it can indicate the level of confidence that institutional investors have in the company's performance and prospects.	
Firm size	Firm size (FS) is determined by taking the natural logarithm of total assets. The use of logarithms helps alleviate issues related to heteroscedasticity.	
Firm leverage	The firm's leverage (Lev) measure is determined by dividing total debt by total assets.	
Asset tangibility	Tangibility = Property, plants& equipment (PPE) divided by total assets (annual)	
Investment scale	The investment scale (INVSCALE) of firms is determined by assessing the ratio of cash utilized for acquiring fixed assets, intangible assets, and other long-term assets to the total assets during the current period.	

(*continued on next page*)

Table A1 (*continued*)

Variables	Variables measurement	Sources
Herfindahl-Hirschman index	The diversification level is calculated through the Herfindahl index (HHI). To compute HHI we used the following formula: $HHI = \sum_{i=1}^{n} P_i^2$, where "n" represents the number of firms (segment) at the four-digit SIC code level for a firm, and "(Pi) " signifies the proportion of sales from each segment "p." The HHI value falls within the range of 0–1, with 0 indicating a focused firm and 1 indicating a fully diversified firm.	
Inflation	INF Annual inflation	World bank data base.
Gross domestic product	GDP (Growth)	

Note. This table outlines the variables' descriptions.

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