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Does financial flexibility drive firm's risk-taking in emerging markets? The moderating role of investment efficiency

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Abstract

Using a sample of 2301 listed firms from emerging markets for 2014–2023, we examine the effect of financial flexibility (FF) on firm risk-taking (FRT) and how this relationship is moderated by investment efficiency (INVEFF). GMM and bias-corrected method of moments models indicate a positive impact of FF on FRT. Notably, INVEFF emerges as a significant moderator, influencing the FF–FRT relationship. High INVEFF strategically amplifies the effect of FF on FRT. Robustness analysis ensures the stability of study findings. This study contributes valuable insights to the nuanced understanding of the FF–FRT relationship in emerging markets.

JEL CLASSIFICATION
G32, G28, G3

1 | INTRODUCTION

In today's dynamic and uncertain markets, the association between financial flexibility (FF) and firms' risk-taking (FRT) has become a pivotal subject of investigation. Amid economic complexities, environmental uncertainties, and the continually evolving regulatory landscape, the adept management of financial resources is crucial for ensuring the sustainable economic development of organizations (Chang & Wu, 2021; Hunjra et al., 2024; Mishra, 2024; Tang & Chang, 2024). The repercussions of the global fiscal crisis in 2007–2008 and the subsequent challenges posed by the COVID-19 pandemic highlight the critical imperative for businesses to skillfully manage financial flexibility and navigate risks in an ever-changing global economic scenario. The pressing need for companies to swiftly adapt and respond to uncertainties emphasizes the timeliness and relevance of exploring the role of financial flexibility in a firm's risk-taking, as emphasized by Liu and Chang (2020).

Drawing on prior research, financial flexibility has been recognized as a critical factor influencing the financial risks undertaken by businesses (Biddle et al., 2009; Myers, 2003; Opler et al., 1999). The ability of a company to pivot financially significantly impacts its capacity to undertake environmental initiatives, gain a competitive edge, and make strategic decisions (Denis, 2011; Marchica & Mura, 2010). Recent research underscores enterprises' need for adaptability and practical risk management skills amid environmental uncertainties. It also emphasizes the proactive allocation of financial resources in response to unforeseen events, such as the 2008 financial crisis (Borio, 2014), affecting strategic decisions, sustainability efforts, and competitive advantages.

This evolving perspective goes beyond mere adaptation, emphasizing the dynamic nature of financial flexibility (Díez-Esteban et al., 2017; Liu & Chang, 2020; Naseer et al., 2024). A vital indicator of a company's financial flexibility is its ability to generate new capital. This reserve empowers companies to grow, enhance earnings, and maintain financial control, especially in volatile markets. Offering access to funding without significant cost, this capacity aids groups in restructuring as needed. Financially flexible businesses exhibit resilience in economic downturns and are poised to seize growth opportunities (Arslan-Ayaydin et al., 2014; Gamba & Triantis, 2008). In conclusion, financial flexibility emerges as an

adaptable and strategic asset, transcending conventional wisdom in fiscal management.

Firms' risk-taking, vital for adapting to market changes and boosting competitiveness, is not solely contingent on managerial willingness but also constrained by a company's funding capabilities (Almeida & Campello, 2007; Fazzari et al., 1987; Huang et al., 2023; Smieja et al., 2023). Engaging in calculated risk-taking is imperative for businesses to adapt to market dynamics, enhance competitiveness, and explore opportunities for higher returns (Acharya et al., 2011; Cucculelli & Ermini, 2013; Low, 2009). However, managers frequently encounter obstacles like agency problems and financing constraints, which make it hard for them to pursue profitable investment projects that are inherently risky (John et al., 2008). The sustainable development of an organization is built upon the foundation stone of enterprises' risk-taking. The fact that some companies may go under because they dared to take risks is a fact. It is paramount in strategic management and long-term economic development to figure out the elements that impact the degree to which organizations take risks and how these affect firms' risk-taking.

Prior studies have investigated various factors that influence firms' risk-taking behavior, such as management characteristics (Coles et al., 2006; Faccio et al., 2016), corporate governance, institutional factors (Chen et al., 2013; López-Gamero & Molina-Azorín, 2016), external environmental factors like the risk of climate change for firms (Naseer et al., 2024), firms' incentives for risk-taking (Mishra, 2024), and CEO overconfidence by Tang and Chang (2024). Prior research has yielded conflicting findings about the impact of financial flexibility on firms' propensity for risk-taking. Some studies have found a positive association (Bancel & Mittoo, 2011), while others have identified a nonlinear relationship (Chang & Wu, 2021) or even a negative one (Minh & Vinh, 2022). Although there has been persistent discussion in recent literature regarding the impact of financial flexibility on firms' risk-taking, there remains a lack of knowledge regarding the precise connection between financial flexibility and firms' risk-taking behavior. Given this context, the primary aim of this study is to fill this gap by investigating the impact of financial flexibility on the risk-taking using a sample of listed firms of four emerging markets (Brazil, Russia, India, and China [BRIC]).

Furthermore, a distinct body of work provides insight into the moderating function of various mechanisms in the correlation between financial flexibility and firms' risk-taking. However, a significant gap exists in comprehending the underlying mechanisms (Wu et al., 2023). Within this context, only a limited number of research have presented evidence demonstrating the beneficial influence of investment efficiency (INVEFF) in enhancing the impact of financial flexibility on firms' willingness to take risks. Nevertheless, conducting a more thorough investigation into the precise methods or practices contributing to INVEFF would yield further valuable insights. Although studies conducted by Hu et al. (2023), Kopyrina et al. (2023), and Liu and Wu (2023) have examined the significance of INVEFF to financial flexibility, there is still limited research on this topic. Several possible justifications exist for employing a hypothetical mechanism to influence the connection between financial flexibility and organizations' propensity for risk-taking. As firms leverage their financial flexibility for strategic decisions, the efficiency in allocating resources to various investment opportunities becomes a crucial element. Enhanced INVEFF has the potential to serve as a moderator, strengthening the favorable impacts of financial flexibility on enterprises' propensity for risk-taking. It enables firms to make informed and value-maximizing investment decisions.

Conversely, a decline in INVEFF may result in inefficient allocation, thus hindering the achievement of advantages. Recent studies emphasize the necessity of balancing the trade-off between efficiency and bias in research. To accomplish this, we propose extending the duration and employing dynamic panel models as a viable remedy for endogeneity.

The study is motivated by the complex interplay between FF and FRT in emerging markets (BRIC). Recognizing the evolving financial landscape and economic growth in these markets, the research explores how INVEFF moderates this relationship. Insights into diverse industries offer a nuanced understanding of nonfinancial firms' strategies amid varying economic maturity and regulatory environments. With these emerging markets integrating into the global economy, understanding the influence of INVEFF on financial decisions is crucial for investors managing risks and seeking opportunities (Demerjian et al., 2020; Saeed & Sameer, 2017). Emerging markets, characterized by rapid economic growth and evolving financial landscapes, provide a unique context to examine the connection between financial decisions and risk behavior, as indicated by Bancel and Mittoo (2011), Chang and Wu (2021), Ma and Jin (2016), Minh and Vinh (2022), and Zhou et al. (2020). Thus, this paper directs its focus toward examining the effect of financial flexibility on shaping firms' risk-taking and how this effect is moderated by investment efficiency. We acknowledge INVEFF and financial flexibility as dynamic and strategic resources in emerging economies, extending beyond conventional financial management paradigms.

Our primary contribution is investigating the relationship between FF and FRT using a sample of listed firms in four emerging markets (BRIC). Prior research has offered anecdotal evidence regarding the impact of FF on FRT, revealing a puzzle marked by diverse correlations. These correlations range from positive, as indicated by Bancel and Mittoo (2011), to non-linear, as observed by Chang and Wu (2021), and negative, as suggested by Minh and Vinh (2022). Second, we explore the moderating effect of INVEFF. Third, methodologically, to address endogeneity, we employ the two-stage dynamic panel generalized method of moments (GMM) by incorporating the lagged dependent variable. Additionally, our study applies the newly introduced bias-corrected method of moments (BCMM) by Breitung et al. (2022) for linear dynamic panel data models, addressing challenges like higher-order autoregressive dynamics, unbalanced panel datasets, and individual-specific heteroscedasticity in large panels with fixed time frameworks. Furthermore, we utilize two alternative measures of firms' risk-taking in arrangement with recent literature: (1) Z-score (Cao & Juelsrud, 2022; Nakano & Nguyen, 2012) and (2) research and development (R&D) investment (Coles et al., 2006). We include the cash holding ratio as an alternative proxy for FF (Ma &

Jin, 2016). We also adopt the model proposed by Chen et al. (2017) as a secondary measure to evaluate INVEFF. Furthermore, we perform multiple robustness checks to validate our main findings.

In empirical work, we investigate the effect of FF on FRT in four emerging markets (BRIC) from 2014 to 2023. As anticipated, findings from our two-step dynamic panel GMM and bias-corrected methods of moments models reveal the positive impact of FF on FRT, aligning with theoretical expectations. Furthermore, the relationship between FF and FRT is influenced by INVEFF. The research emphasizes the need for FF for smart decision-making. According to the resource-based view (RBV), reasonable resource allocation boosts a firm's competitiveness, which explains INVEFF's moderation. Highly efficient investment amplifies the influence of FF on company risk-taking. FF boosts FRT, as shown by real options theory (ROT), pecking order theory (POT), and agency theory. Our comprehensive tests confirm this stability, confirming our results' resilience and trustworthiness. This research offers a new perspective on FF and corporate risk-taking within emerging economies, providing practical insights for companies' management through complex financial environments.

The theoretical foundation and development of hypotheses are presented in Section 2. The data and methodology used are described in Section 3. In Section 4, we provide and discuss empirical data. Section 5 provides a summary of the conclusion.

2 | THEORETICAL FRAMEWORK AND HYPOTHESIS DEVELOPMENT

Researchers systematically incorporated diverse theoretical frameworks, namely, agency theory, resource-based theory, legitimacy theory, and stakeholders' theory, to broadly analyze the intricate relationship between FF, investment efficiency, and the propensity of firms to undertake risks. The earliest FF theory originated from research on the tax management of enterprise capital structures, which posits that future risks and opportunities coexist, and an enterprise must maintain a specific financing capacity (Miller & Modigliani, 1963). As a relatively new research field in financial management, the definition of FF has not been universally established. Further agency theory was put forward by Eisenhardt (1989) and Jensen and Meckling (1976) as a theoretical framework to explain the relationship between shareholders or owners of corporations and their agents and to resolve conflicts of interest between principals and agents. In traditional financial theory, there is a significant link between risk and returns, with higher risks leading to greater returns and vice versa (Fama & MacBeth, 1973).

Further theoretical literature extends and integrates prominent theories, including POT and ROT. According to POT, companies prefer using internal funds over external sources, and asymmetric knowledge makes it more difficult for companies to get external financing, as proposed (Myers, 1984). Moreover, the ROT states that financially flexible firms have the ability to pursue opportunistic investments due to their internal flexibility (Trigeorgis & Reuer, 2017). Additionally, resource dependency theory (RDT) posits that organizations rely on external resources to function effectively and emphasizes acquiring resources to reduce dependency on a sole source to ensure a diverse and robust set of resources. Further, RDT highlights that INVEFF empowers companies to obtain the necessary resources, shaping their ability to engage in risk-taking effectively (Bromiley, 1991). Agency theory fundamentally aims to address conflicts of interest between principals and agents while elucidating the relationship between business owners and shareholders (Shapiro, 2005; Tran, 2020). According to agency theory, businesses often put too much money into enterprises that will not pay off in the long run, primarily where inadequate monitoring and weak corporate governance exist. Eventually, this causes agency issues (Kanga et al., 2020; Minh & Vinh, 2022; Naeem & Li, 2019; Stein, 2003). Theoretically, even with low debt, managers (agents) who put their interests ahead of the shareholders (principals) may make adverse decisions about firm investments and private rewards. Inefficient investments and FF can arise from under- or overinvestment, depending on the agent's (management's) disposition (Gao et al., 2021; Menshawy et al., 2021; Naeem & Li, 2019).

2.1 | The connectedness between FF and FRT

In a business setting, FRT refers to the propensity for companies to engage in actions or make decisions that might have both positive and negative consequences. Taking risks is an inherent part of making strategic decisions in businesses. Thoroughly assessing the situation, planning strategically, and managing risks effectively are standard components of successful risk-taking. Thus, the strategic goal-attainment practice entails intentional exposure to uncertainty. Palmer and Wiseman (1999) distinguish between two types of corporate risk-taking: managerial and organizational. Making proactive strategic decisions on the allocation of resources is an example of managerial risk-taking. These decisions might lead to organizational changes and introduce uncertainty. Concerning risk-taking, the main focus is the uncertainty surrounding the firm's revenue (Bowman, 1984; Bromiley, 1991). Participating in FRT requires a significant investment of resources, which shows that businesses are willing to invest money in uncertain projects.

A fundamental and influential work that significantly shaped our comprehension of the connection between corporate risk and return is Fischer Black and Myron Scholes' pivotal 1974 article, "Corporate Risk and Return" (Black & Scholes, 1974). This seminal contribution has made a long-term impact, establishing the groundwork for examining profitability and risk in corporate contexts. Palmer and Wiseman (1999) differentiate FRT into "managerial risk taking," involving proactive strategic decisions by management and FRT, which revolves around the uncertainty concerning the firm's income or earnings.

On the other hand, FF has been recognized in the literature as a significant factor influencing the level of risk that businesses are willing to undertake. This underscores its pivotal role in shaping corporate decisions related to risk-taking (Gamba & Triantis, 2008). FF is often assessed through leverage and cash holdings. The emphasis on maintaining substantial cash reserves aims to enhance a firm's

capacity to effectively navigate unforeseen future shocks (Denis & McKeon, 2012). The ability of enterprises to adapt and remain resilient in the presence of environmental uncertainty is conceptualized as FF (Islam et al., 2019). In a past study, Biddle et al. (2009) found that the amount of FF is a significant indicator of the level of risk companies are ready to take on. The ability of the corporation to generate funds is demonstrated by its unused debt capacity, as explained by Chang and Wu (2022). A company's ability to make strategic decisions depends on its FF and willingness to take risks (Liu & Chang, 2020). Moderate FF can ensure a company's access to capital, improve its ability to manage risks, and offer opportunities to fully exploit suitable investment prospects (Gu & Yuan, 2020), as observed in both emerging and industrialized nations.

Furthermore, it has been suggested that when comparing developing nations to developed ones, FF has a more significant impact on the valuation of firms in the former (Bilyay-Erdogan, 2020). It is acknowledged that real-world financial markets are not expected to be perfect. A recent study by Díez-Esteban et al. (2017) states that in pursuit of strategic objectives, firms' risk-taking is the deliberate exposure of an organization to uncertainty. The degree of risk-taking is contingent upon the organization's risk tolerance and strategic direction. Liu and Chang (2020) argue that it is difficult for firms to risk taking efforts to be sustainable without sufficient financial backing. Therefore, Hunjra et al. (2024) state that FF is an important part of businesses' financial decision-making process since it helps them maintain their debt capacity and ability to get future funding.

According to Liu and Chang (2020), the sustainability of FRT strategies is difficult to achieve without significant resource assistance. A successful firm's risk-taking requires rigorous appraisals, strategic formation, and efficient risk management to increase the potential benefits while reducing the latent drawbacks. Thus, by helping to maintain debt capacity and future financing capability, boosting competitiveness, and building a stable market position, firm FF plays an essential part in making financial decisions.

Agency theory focuses on resolving conflicts between principals and agents in organizational settings. The proposal suggests that managers may display different levels of risk-taking behavior based on their FF. Managers may prioritize their interests over those of shareholders, which could result in less-than-optimal decisions regarding corporate expenditures and research and technology operations (Jensen & Meckling, 1976). The adaptive market hypothesis posits that financial markets and players adjust to evolving conditions (Hunjra et al., 2024), indicating that the connection between firm FF and risk-taking may fluctuate in diverse economic scenarios (Bancel & Mittoo, 2011).

Many studies have examined the elements of FRT that affect business performance and the formation of a basis for long-term organizational success (Chang & Wu, 2021). The willingness of a company to engage in risky ventures is directly linked to its resource capacity and the capability of its forthcoming resource acquisitions (Kuo et al., 2021). Prior studies have explored various determinants of firm risk taking such as management characteristics (Coles et al., 2006; Faccio et al., 2016), corporate governance (Acharya et al., 2011; Kini & Williams, 2012), institutional factors (López-Gamero & Molina-Azorín, 2016), and external environmental elements, including firm climate change risk (Naseer et al., 2024), risk-taking incentives (Mishra, 2024) and CEO overconfidence (Tang & Chang, 2024). The effects of FF on business performance and firms' risk-taking behavior have been the subject of numerous research. According to Zhang and Geng (2018), who used the resource reliance theory as their foundation, FF significantly promotes risk-taking. During the COVID-19 epidemic, researchers (Chang & Wu, 2021) observed stock exchange companies to see if FF affected their risk-taking tendencies. The findings point to a U-shaped association between FF and the risk-taking behavior of businesses. FF and institutional investors significantly and positively impact firms' risk-taking. While previous research has yielded mixed results on the impact of FF on FRT, ranging from positive correlations (Bancel & Mittoo, 2011) to nonlinear relationships (Chang & Wu, 2021) and negative associations (Minh & Vinh, 2022), there exists a gap in understanding the specific relationship between FF and firm risk taking.

Research indicates that FF significantly shapes the extent of risk-taking businesses embrace. FF metrics commonly evaluated include leverage and cash reserves, which are crucial for managing unforeseen challenges (Denis, 2011). FF enhances a firm's ability to adapt and maintain resilience in environmental uncertainty. Previous studies have explored factors influencing FRT, such as managerial traits, corporate governance, institutional dynamics, and external environmental factors like climate change risk and CEO overconfidence.

While previous studies have shown mixed results regarding the impact of FF on risk-taking, with findings ranging from positive correlations to nonlinear relationships and even negative linkage, it remains crucial to address this gap, especially in emerging economies. Firms in these markets often face more significant environmental uncertainties and stringent financial constraints than those in developed markets. Consequently, the relationship between firms' FF and risk-taking may be more critical in emerging economies due to the increased need for financial adaptability and efficient resource allocation in unpredictable environments. Understanding this dynamic is vital for firms in emerging markets as they navigate the complexities of economic volatility and strive for sustainable growth. Based on the theoretical foundation and the unique context of emerging markets, we first postulate the following as a theoretical prediction:

> **H1.** Financial flexibility significantly increases firms' risk-taking.

2.2 | Moderating role of INVEFF between FF and FRT relationship

INVEFF is a measure used to evaluate how effectively companies utilize the funds they invest in acquiring assets. The impact of INVEFF on risk, company value, and performance has been the subject of various studies. For instance, Leahy and Whited (1995) found no statistically significant link between INVEFF and risk, while Baum et al. (2006) observed a positive correlation between INVEFF and

uncertainty. Panousi and Papanikolaou (2012) discovered a negative correlation between corporate INVEFF and idiosyncratic risk. In examining INVEFF in Pakistan, Raza et al. (2021) found that it plays a crucial role in FF and corporate success. INVEFF is a measure of how well a company uses its assets (Chen et al., 2017). Alkaraan (2023) states that investment in R&D and other forms of innovation can enhance a company's intangible asset capacities.

Despite existing research, there is a notable lack of studies on the significance of INVEFF as a reinforcement element for FF (Hu et al., 2023; Kopyrina et al., 2023; Liu & Wu, 2023; Wu et al., 2023). The relationship between FF and FRT can be influenced by INVEFF in several ways. High INVEFF could potentially enhance the positive effects of FF on RT, providing businesses with the tools they need to make better investment decisions and increase shareholder value. Conversely, INVEFF might hinder efficient allocation, thus affecting the attainment of benefits (Hu et al., 2023; Kopyrina et al., 2023; Liu & Wu, 2023; Wu et al., 2023). While other studies have explored the moderating effects of various mechanisms on the link between FF and RT, for example, board gender diversity (Hu et al., 2023) and institutional ownership (Huang et al., 2023), thus we note that there is a significant gap in understanding how INVEFF specifically moderates this relationship (Hu et al., 2023; Kopyrina et al., 2023; Liu & Wu, 2023).

Our second hypothesis aims to fill this gap by exploring the potential of INVEFF to amplify the positive effects of FF on FRT. The rationale is that high levels of INVEFF can allow firms to leverage their FF more effectively, leading to better investment decisions and increased value creation. Therefore, we propose the following hypothesis:

> **H2.** Investment efficiency positively moderates the relationship between financial flexibility and firms' risk-taking, such that higher investment efficiency strengthens the positive effect of financial flexibility on risk-taking.

This study seeks to test hypothesis H1 to establish the foundational relationship between FF and risk-taking. In contrast, H2 introduces investment efficiency as a crucial moderator to enhance this relationship, particularly in emerging markets where financial adaptability and efficient resource allocation are critical. Understanding how INVEFF interacts with FF provides deeper insights into strategic decision-making in these dynamic environments.

2.3 | Theoretical framework

The theoretical framework underpinning our investigation into the relationship between FF and FRT integrates vital theories. Agency theory acts as a vigilant monitoring mechanism, mitigating agency costs within a company. Active participation in strategic decision-making, mainly through voting, moderates the dynamics between FF and FRT, as highlighted by Eisenhardt (1989), Jensen and Meckling (1976), Shapiro (2005), and Tran (2020). POT posits that companies prioritize internal funds, aligning with FF, where reliance on internal funds correlates with a propensity for risk-taking (Myers, 1984). Fundamental options theory (ROT) suggests that financially flexible firms can seize opportunistic investments due to their internal flexibility, emphasizing the significance of flexibility in decision-making amid uncertainty (Trigeorgis & Reuer, 2017). RDT underscores INVEFF as a vital mechanism enabling firms to secure essential resources, influencing their capacity for effective risk-taking (Bromiley, 1991). Acquired resources, facilitated by investment efficiency, significantly shape a firm's effectiveness in risk-taking. The robustness of a company's resource foundation, influenced by these mechanisms, is crucial in determining its strategic risk-taking capability. The study, focused on emerging markets (BRIC), explores FF and FRT in diverse economic and regulatory environments, providing insights into the challenges and opportunities firms face navigating varying degrees of economic maturity and market dynamics. This approach provides a detailed understanding of financial decisions and risks. In summary, our study seeks to address a literature gap by investigating how FF influences FRT, explicitly emphasizing the moderating role of INVEFF in the context of emerging markets. Figure 1 serves as the conceptual framework, providing the theoretical foundation for our exploration.

3 | DATA AND METHODOLOGY

3.1 | Data and sample

We examined an unbalanced dataset of 20,009 firm-year observations from 2014 to 2023, including 2301 listed enterprises from BRIC. Emerging economies were chosen for this study because of their dynamic nature and essential economic contributions, giving a rich setting to examine FF, company risk-taking, and investment efficiency.

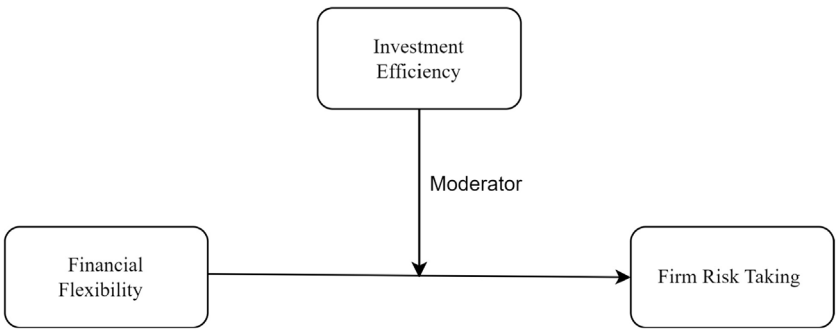

FIGURE 1 The study conceptual model.

Our study sampled different industries and attempted to provide a broader view of economic sectors, revealing nonfinancial enterprises' strategies and actions. As emerging markets integrate into the global economy, investors seeking opportunities and managing risks in growth-oriented environments must understand how INVEFF affects financial decisions (Chang & Wu, 2021; Demerjian et al., 2020; Hunjra et al., 2024; Saeed & Sameer, 2017). We focus on BRIC countries due to their economic significance, diverse environments, regulatory frameworks, and market conditions, providing comprehensive insights into FF and FRT behaviors relevant to global investors, managers, and policymakers. We used S&P Capital IQ, CSMAR, and World Bank data for empirical study. We selected samples based on the availability of firm-level data for risk-taking, FF, investment efficiency, and other critical business characteristics used in our experiments.

To start sampling, we identified nonfinancial enterprises listed on the Moscow Exchange, Bombay Stock Exchange, Shanghai, Shenzhen, and BOVESPA (Bolsa de Valores de São Paulo) in Russia, India, China, and Brazil. We then established sampling criteria.

1. We consider firms with at least five 5 years of earnings data starting from the current year to calculate enterprise risk-taking characteristics.
2. We omitted firm-year observations if any variable of interest was absent.
3. We also omitted financial and regulated utility enterprises.

Due to capital structure and independent regulatory authorities, financial and utility firms were excluded. We controlled variable outliers with winsorization at 1% and 99%. Table 1 provides the country-specific sample observation breakdown.

3.2 | Variable construction

Based on the studies conducted by Cao and Juelsrud (2022), Habib and Hasan (2017), Li et al. (2013, 2021), and Shahzad et al. (2019), we utilize the standard deviation of return on assets ROA[1] during the previous 3 years as a measure of firm risk-taking (FRT). The standard deviation of ROA is calculated by scaling the standard deviation of returns by the total assets. Equation (1) is employed for quantifying FRT.

$$FRT_{i,t} = \frac{\sqrt{\sum_{i=1}^{n}\left(ROA_i - \overline{X}\right)^2}}{n} \quad (1)$$

where n is the number of observations (in this case, three for each year), ROA_i is the ROA value for each year, and $\overline{X}$ is the mean (average) of the ROA values.

In addition to our primary measure of FRT, we employ two alternative measures for robustness checks, as suggested in recent literature: (1) Z-score (Cao & Juelsrud, 2022; Nakano & Nguyen, 2012) and (2) R&D investment (Coles et al., 2006).

For FF measurement, we follow Arslan-Ayaydin et al. (2014), Chang and Wu (2021), Hao et al. (2022), Teng et al. (2021), and Tran (2020). Equation (2) is used to calculate the FF of firms.

$$FF = cash\ flexibility_{i,t} + debt\ flexibility_{i,t} \quad (2)$$

where *cash flexibility* refers to an organization's capacity to employ its internal financial resources effectively. The calculation involves taking the sum of the firm's cash and cash equivalent and dividing it by the annual total assets. On the contrary, (DF) *debt flexibility* refers to a company's capacity to obtain external cash and is computed as (DF) = 1 minus the company's debt ratio. To measure robustness, we utilize the cash holding ratio as a substitute indicator for FF, as previously employed by Ma and Jin (2016).

In our analysis, we employed the two widely used measures for corporate INVEFF (INVEFF). Current research suggests that the measures for INVEFF proposed by Biddle et al. (2009) and Chen et al. (2011) are valuable for several reasons: (1) They are the most recent metrics for INVEFF, (2) they encompass a broad spectrum of investment categories, and (3) they assess both growth aspects and potential investment opportunities, as highlighted by Ullah et al. (2021). In the principal analysis (Biddle et al., 2009) model for INVEFF calculated using Equation (3).

$$INVEFF_{i,t+1} = \alpha_0 + \beta_1 Sales\ Growth_{i,t} + \varepsilon_{i+t} \quad (3)$$

In the model framework, the variable $INV_{i,t+1}$ denotes the aggregate investment within a specific industry-year group, while $Sales\ Growth_{i,t}$ acts as a proxy for investment opportunities, representing the percentage change in sales within the same industry-year group from year $t-1$ to t. The cross-sectional estimation is conducted annually and by industry, with residuals serving as indicators of deviations from the anticipated investment level. A positive residual implies overinvestment, indicating a level of investment beyond what is expected concerning sales growth. Conversely, a negative residual suggests underinvestment, signaling an investment level below the expected threshold based on sales growth. Consequently, the test variable INE is constructed as the absolute value of residuals multiplied by -1 and is treated as the dependent variable in the model, reflecting the degree of efficiency in investment decisions. For

TABLE 1 Country-specific sample observations breakup.

S. no.	Country	No. of firms	Observations	Percentage
1	Brazil	253	2504	12.52%
2	Russia	551	3915	19.56%
3	India	642	5187	25.93%
4	China	855	8403	41.99%
	Total	2301	20,009	100%

Notes: This table provides the number of firms and total observations included in the study from 2014 to 2023, categorized by country. The percentage column indicates the proportion of observations each country contributes to the dataset.

robustness, we adopt the model proposed by Chen et al. (2017). Numerous studies in corporate finance research examine the correlation between FF and different aspects of corporate finance and risk management. It is clear that various factors at different levels, including the overall economy, specialized industries, and individual firms, contribute to risk-taking. Consequently, this study incorporates a set of control variables, including firm size, firm leverage, cash flow, LN age, Kaplan–Zingales index, Big 4 presence, Herfindahl–Hirschman index, inflation, and gross domestic product, following the methodology employed by Cao et al. (2020, 2021), Chang and Wu (2021), Phan et al. (2021), and Tran (2020). The details of these variables are presented in Table 2.

3.3 | Economic model setting and empirical design

To empirically examine the relationship between study variables, we begin with a fixed effect to account for unobserved heterogeneity and to mitigate endogeneity concerns. We also employ a two-step GMM model.

$$FRT_{i,t} = \alpha_0 + \beta_1 FF_{i,t} + Controls\ldots + V_I IFE + \eta_1 YFE + \chi_1 CFE + \varepsilon_{i,t} \quad (4)$$

$$FRT_{i,t} = \alpha_0 + \beta_1 FF_{i,t} + \beta_2 INVEFF_{i,t} + \beta_3 (FF_{i,t} \times INVEFF_{it}) + Controls + V_I IFE + \eta_1 YFE + \varepsilon_{i,t} \quad (5)$$

$$FRT_{i,t} = \alpha_0 + \Upsilon_1 FRT_{i,(t-1)} + \beta_1 FF_{i,t} + Controls\ldots + V_I IFE + \eta_1 YFE + \varepsilon_{i,t} \quad (6)$$

$$FRT_{i,t} = \alpha_0 + \delta_1 FRT_{i,(t-1)} + \beta_1 FF_{i,t} + \beta_2 INVEFF_{i,t} + \beta_3 (FF_{i,t} \times INVEFF_{it}) + Controls + V_I IFE + \eta_1 YFE + \varepsilon_{i,t} \quad (7)$$

The constituents of our financial modeling are as follows: ERT represents enterprise risk-taking. ΥERTi(t − 1) represents lag dependent variables, FF denotes financial flexibility, firm risk-taking (FRT), firm's financial flexibility (FF), investment efficiency (INVEFF), firm's size (Firm Size), firm leverage (Leve), cash flow, LN age (LN Age), Kaplan–Zingales index (KZ Index), Big 4, Herfindahl–Hirschman index (HHI), inflation (INFLN) and gross domestic product (GDP). V_IIndustry fixed effect (IFE), Year fixed effect(YFE), $\varepsilon_{i,t}$ is an error term in all regression models and χ_1 CFE is a country-fixed effect.

In our empirical investigation, we employ various estimators to ensure the robustness of our analysis. The fixed effects and high-dimension fixed effects (HDFE) are utilized to incorporate fixed effects for companies, years, and countries, effectively addressing concerns related to serial/autocorrelation and heteroskedasticity, as used by Agoraki et al. (2024), Bagh et al. (2024), and Mbanyele and Muchenje (2022). Next, given that the baseline model results may prompt endogeneity concerns, we utilize a dynamic two-stage generalized method of moments (2S-GMM) (Iftikhar et al., 2024). In GMM estimation, we introduce lagged dependent variables, focusing mainly on the lagged dependent[2] variable FRT. In addition, we apply the BCMM estimation as this method introduces cluster-robust/panel-corrected standard errors, managing cross-sectional dependence (CSD) and higher-order autoregressive models (Bataineh et al., 2023; Breitung et al., 2022).

TABLE 2 Variable details.

Variables	Symbol	Measurement
Firms' risk-taking	FRT	Equation (1)
Financial flexibility	FF	Equation (2)
Investment efficiency	INVEFF	Equation (3)
Firm size	Firm Size	Firm size, quantified by the natural logarithm of total assets
Firm leverage	Leve	Financial leverage is indicated by the total debt ratio
Cash flow		Cash flow represents the cash flow from operating activities normalized by total assets
LN age	LN Age	LN (current year minus incorporation year plus one)
Kaplan–Zingales index	KZ Index	The KZ Index is calculated using the formula: = − 1.001909 × cash flows/K + 0.2826389 × Q + 3.139193 × debt/total capital + −39.3678 × dividends/K + −1.314759 × cash/K where K = PP&Et-1 and Q = total shareholder's equity market capitalization total + shareholder's equity − book value of common equity − deferred tax assets/total shareholder's equity
Big 4	Big 4	The "BIG 4 audit" dummy variable is binary, with a value of 1 indicating that a firm's financial statements are audited by one of the Big 4 audit firms and a value of 0 signifying either an audit by a non-Big 4 firm or the absence of an external audit for the firm
Herfindahl–Hirschman	HHI	$HHI = \sum_{i=1}^{n} (s_i)^2$
Inflation	INFLN	Annual inflation
Gross domestic product	GDP	Annual growth in GDP

Source: S&P Capital IQ, China Stock Market & Accounting Research (CSMAR) database, and WBD—World Bank data.

4 | RESULTS AND DISCUSSION

4.1 | Descriptive statistics

Table 3 provides a comprehensive overview of descriptive statistics, encompassing total observations, mean, standard deviation, percentiles, and minimum and maximum values for the analyzed variables. The analysis includes the dependent variable, FRT, the independent variable, FF, the moderator variable, INVEFF, and control variables. The dataset encompasses 20,009 firm-year observations from 2014 to 2023, incorporating listed firms from four emerging markets (BRIC), with detailed variable definitions in Table 1. FRT, measured by the standard deviation of return scaled by assets over the past 3 years, exhibits a mean of 0.249 and a standard deviation of 0.293, indicating a moderate level of risk-taking within the dataset. The variability, reflected in the standard deviation, signifies differing risk propensities among observed firms. The maximum value of 5.444 highlights firms displaying an above-average risk-taking stance, contributing to the dataset's diversity in risk profiles. FF demonstrates a mean of 0.747 and a standard deviation of 0.631, suggesting a moderate average level of FF among observed firms, with variability indicating differences in FF across the dataset. The maximum value of FF, reaching 3.973, points to cases where firms exhibit higher-than-average FF, contributing to the diversity of financial profiles in the sample.

Furthermore, INVEFF, the moderating variable, has a mean of 0.203. Similarly, Table 3 incorporates summary statistics for the control variables at both the firm level and macroeconomic level, including firm size, firm leverage, cash flow, LN age, Kaplan–Zingales index, Big 4, Herfindahl–Hirschman index, inflation, and gross domestic product. Additionally, Table 3 provides VIF values estimated after OLS estimation,[3] meeting the criteria of being below 10, ensuring the absence of multicollinearity concerns in the analysis.

4.2 | Addressing multicollinearity and stationarity of variables

Next, pairwise correlations among independent variables are examined to assess multicollinearity further. Figure 2 visually presents the correlation matrix, and the results confirm the absence of multicollinearity issues. Tables A1 and A2 summarize test results using first- and second-generation unit root frameworks.[4] The ADF–Fisher test is suitable for unbalanced panel data, assuming complete cross-sectional independence. The second-generation PCIPS test addresses cross-sectional reliance, validating the hypothesized order of integration. The unit root results indicate estimates from PCIPS baseline results and ADF–Fisher, suggesting no stationarity issues in the dataset.

Table 4 presents robust fixed effects and HDFE models' results. Columns 1 and 2 focus on the direct impact of FF on FRT, revealing a positive and statistically significant influence, supporting the primary hypothesis (H1) of the study. Columns 3 and 4 examine the moderation effect of INVEFF as a moderating factor in shaping the relationship between FF and FRT. The study finds that INVEFF significantly strengthens this relationship, denoted as FF*INVEFF. These outcomes affirm H2. Importantly, these patterns are consistent across fixed effect robust and HDFE models. In our fixed effects model specification, we include both country and year-fixed effects. However, we substitute firm effects with country effects in the HDFE model. This adjustment allows us to control for country-specific and firm-specific unobservable heteroscedasticity

TABLE 3 Summary statistics.

Variables	Obs.	Mean	SD	Min	p25	Median	p75	Max	VIF	1/VIF
FRT	20,009	0.249	0.193	0.003	0.373	0.675	0.921	5.644		
FF	20,009	0.747	0.631	0.001	0.241	0.791	1.046	3.973	1.899	0.527
INVEFF	20,009	0.203	0.110	0.000	0.053	0.131	0.358	0.812	1.678	0.596
Firm Size	20,009	0.067	0.187	0.000	0.033	0.063	0.658	7.908	1.449	0.690
Leve	20,009	0.428	0.777	0.005	0.223	0.549	0.579	0.832	1.038	0.963
Cash flow	20,009	0.041	0.229	0.000	0.284	0.469	0.649	0.791	1.029	0.972
LN Age	20,009	2.263	0.354	1.043	0.166	0.303	1.545	3.532	1.016	0.984
KZ Index	20,009	0.563	2.449	−7.909	−0.777	0.827	2.131	11.627	1.006	0.994
Bigf4	20,009	0.065	0.096	0.000	0.025	0.054	0.079	1.000	1.006	0.994
HHI	20,009	0.065	0.086	0.002	0.009	0.056	0.877	1.000	1.001	0.999
INFLN	20,009	3.536	2.435	−0.003	1.407	3.332	4.372	16.275	1.001	0.999
GDP	20,009	1.761	1.442	−6.596	5.951	6.849	7.766	8.931	1	1.000
Mean VIF									1.193	

Notes: This table summarizes descriptive statistics for the variables in the analysis. The dependent variable is firm risk-taking (FRT), the independent variable is financial flexibility (FF), and the moderator variable is investment efficiency (INVEFF). Additionally, control variables are included in the analysis. The dataset consists of 20,009 firm-year observations covering 2014–2023 and includes listed firms from Brazil, Russia, India, and China. Variable definitions can be found in Table 1.

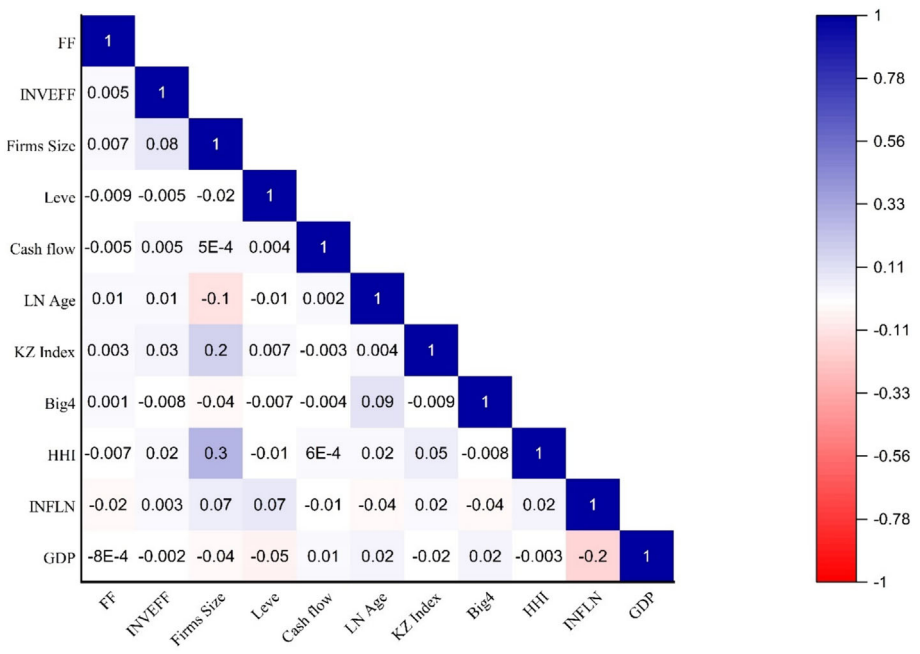

FIGURE 2 Visual presentation of pairwise correlation.

(Ghabri, 2022). Our baseline specification controls firm-level and macroeconomic characteristics: firm size, firm leverage, cash flow, LN age, Kaplan–Zingales index, Big 4, Herfindahl–Hirschman index, inflation, and gross domestic product to gain robust estimations. The R-squared values (0.152 and 0.195) for fixed effects robust models indicate explanatory power in capturing the influence of FF on FRT with year and firm-specific effects. Conversely, the remaining R-squared values (0.179 and 0.217) for HDFE regression models, containing year and country-specific effects, exhibit higher explanatory power. Significant *p*-values from the *F*-test affirm the accurate estimation of our baseline models.

4.3 | Endogeneity: Dynamic panel system GMM and BCMM

Given that the baseline model results may prompt endogeneity concerns, we utilize a dynamic 2S-GMM to address this challenge. In GMM estimation, we introduce lagged dependent variables, focusing mainly on the lagged dependent[5] variable FRT. In addition, we apply the BCMM estimation as this method introduces cluster-robust/panel-corrected standard errors, managing CSD and higher-order autoregressive models (Bataineh et al., 2023; Breitung et al., 2022).

The estimated results in the dynamic panel system GMM and BCMM (Table 5, presented in columns 1–4) reiterate our study baseline findings, even after addressing endogeneity. In the estimation of the 2S-GMM models, the nonsignificance in the AR(2) test supports the adequacy of immediate past values for prediction, signifying no second-order residual autocorrelation. Both the Sargan and Hansen tests, with *p*-values exceeding 0.05, suggest that overidentification becomes irrelevant, confirming the accurate specification of the 2S-GMM with no overidentification issues. Finally, the *p*-values from the Hansen test indicate that the instruments meet orthogonality conditions, affirming their potential validity.

4.4 | Effect of the high versus low FF by utilizing the industry- and year-adjusted median

We employ a binary variable threshold, determined by the industry- and year-adjusted median of FF, to categorize the data. This categorization allows for exploring potential threshold effects, investigating how FF influences FRT at higher (Threshold = 1) and lower (Threshold = 0) levels. To evaluate this hypothesis, we introduce a binary dummy variable (Threshold) that classifies samples into two distinct groups based on higher (1) and lower (0) levels of FF. This analytical approach provides valuable insights into the nuanced impact of FF on FRT, shedding light on the intricacies within these relationships. The regression results in Table 6 highlight the significant influence of FF above the median on FRT. Notably, the moderating effect of (FF*INVEFF) is statistically significant at higher FF (1) levels, whereas columns 3–4 reveal the lack of significance in results at lower FF (0) levels.

4.5 | A pre-COVID, during, and post-COVID analysis

Next, we analyze the impact of COVID-19 as a shock by conducting pre-COVID, during, and post-COVID periods. Table 7 findings suggest distinct differences in the effects of FF and INVEFF on FRT across pre-COVID, during COVID, and post-COVID periods. Pre-COVID results show a strong positive impact of both FF and INVEFF on FRT, with a significant interaction effect indicating that higher FF combined

TABLE 4 Empirical results from baseline regression.

	Direct effect		Moderating effect	
Variables	FE robust (1) FRT	High-dimension FE (2) FRT	FE robust (3) FRT	High-dimension FE (4) FRT
FF	0.281*** (0.012)	0.264*** (0.022)	0.277*** (0.018)	0.279*** (0.026)
INVEFF			0.045*** (0.016)	0.037*** (0.014)
FFs*INVEFF			0.042* (0.025)	0.051*** (0.022)
Firm Size	−0.086*** (0.021)	−0.103* (0.052)	−0.112*** (0.032)	−0.080* (0.047)
Leve	−0.038* (0.021)	−0.042*** (0.019)	−0.052*** (0.023)	−0.038*** (0.006)
Cash flow	0.025** (0.011)	0.013* (0.007)	0.021 (0.009)	0.026 (0.008)
LN Age	0.017* (0.011)	0.023** (0.011)	0.018*** (0.007)	0.016* (0.009)
KZ Index	−0.023* (0.0013)	−0.008** (0.004)	−0.018** (0.009)	−0.013* (0.007)
Big 4	0.041 (0.006)	0.100*** (0.037)	0.099*** (0.037)	0.043 (0.039)
HHI	−0.048* (0.026)	−0.028 (0.019)	−0.026 (0.021)	−0.044*** (0.017)
INFLN	−0.020*** (0.003)	−0.072*** (0.004)	−0.086*** (0.004)	−0.027*** (0.003)
GDP	0.012** (0.006)	0.014*** (0.003)	0.015*** (0.003)	0.003* (0.002)
Constant	1.351*** (0.137)	1.569*** (0.043)	1.546*** (0.042)	1.324*** (0.063)
Observations	20,009	20,009	20,009	20,009
Firm [FE]	Yes	Yes	No	No
Year [FE]	Yes	Yes	Yes	Yes
Country [FE]	No	No	Yes	Yes
R-squared	0.152	0.179	0.195	0.217
F test (Prob > F)	11.70***	14.37***	18.59***	20.16***

Notes: This table presents the outcomes of fixed effects and high-dimension FE estimation. First, we explore the effect of financial flexibility (FF) on firm risk-taking (FRT) in columns 1 and 2. We examine the moderating impact of the interaction term (financial flexibility*investment efficiency, denoted as FF*INVEFF) on FRT, and the results are presented in columns 3 and 4. Standard errors are indicated in parentheses, with significance levels.
***$p < 0.01$, **$p < 0.05$, and *$p < 0.1$.

with higher INVEFF leads to increased FRT. However, during the COVID period, the impact of FF alone on FRT becomes insignificant, while INVEFF continues to influence FRT, albeit with a weaker interaction effect. This suggests that during the economic uncertainty of COVID-19, firms relied more on their INVEFF than FF to drive FRT behaviors. Post-COVID, the impact of both FF and INVEFF on FRT re-emerges strongly, with significant positive coefficients and a moderate interaction effect, indicating a return to the pre-COVID dynamics where both factors jointly enhance FRT. These variations emphasize the importance of context, showing how external economic conditions influence the relative importance of FF and INVEFF in determining FRT behaviors.

4.6 | Country-wise analysis

This study utilizes Wilcoxon signed-rank tests and *t*-statistics[6] to determine the statistical significance of the mean differences among the study variables. The Wilcoxon signed-rank tests and *t*-statistics findings indicate a statistically significant variance in certain factors

TABLE 5 Two-step system GMM and bias-corrected method of moments.

Variables	2SS-GMM (1) FRT	BC-GMM (2) FRT	2-SS GMM (3) FRT	BC-GMM (4) FRT
L.FRT	0.102*** (0.018)	0.108*** (0.025)	0.170*** (0.025)	0.118*** (0.013)
FF	0.264*** (0.061)	0.220*** (0.049)	0.198*** (0.074)	0.158** (0.080)
INVEFF			0.059** (0.030)	0.082** (0.041)
FF*INVEFF			0.032*** (0.013)	0.039*** (0.017)
Firm Size	−0.033* (0.019)	−0.054** (0.027)	−0.046** (0.023)	−0.069*** (0.024)
Leve	−0.029 0.019	−0.038* (0.021)	−0.043*** (0.025)	0.033*** (0.019)
Cash flow	0.027*** (0.010)	0.023* (0.019)	0.018** (0.009)	0.042** (0.0021)
LN Age	0.023* (0.013)	0.027* (0.016)	0.033 (0.025)	0.038** (0.019)
KZ Index	−0.027** (0.014)	−0.020 (0.0010)	−0.023* (0.013)	−0.038** (0.019)
Big 4	0.082** (0.041)	0.061** (0.030)	0.033* (0.019)	0.043* (0.025)
HHI	−0.043*** (0.017)	−0.048 (0.034)	−0.052** (0.070)	−0.039** (0.023)
INFLN	−0.064** (0.032)	−0.040*** (0.013)	−0.053*** (0.021)	−0.042*** (0.015)
GDP	0.033* (0.019)	0.022** (0.009)	0.022** (0.011)	0.029*** 0.010
Constant	1.469*** (0.629)	1.366*** (0.137)	2.409*** (0.739)	2.306*** (0.547)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Number of ids	2301	2002	2301	2002
Sample period	2014–2023	2014–2023	2014–2023	2014–2023
AR(1)_first differ.	0.000	0.000	0.000	0.000
AR(2)_first differ.	−1.62 (0.105)	0.09 (0.000)	−1.43 (0.194)	0.11 (0.000)
AR(3)	—	1.45 (0.143)	—	2.34 (0.179)
Sargan test (prob.)	1.76 (0.972)	1.32 (0.109)	3.07 (0.327)	1.11 (0.159)
Hansen test (prob.)	4.31 (0.377)	3.48 (0.219)	3.42 (0134)	2.48 (0.181)

Notes: This table reports "dynamic panel data two-step system GMM and bias-corrected method of moments (BCMM) estimation." First, we examine the impact of FF on FRT, reported in columns 1 and 2. Subsequently, we evaluate the moderating effect of the interaction term (financial flexibility*investment efficiency) (FF*INVEFF) on FRT, with results presented in columns 3 and 4. In BSMM estimation, 299 groups are excluded due to data gaps or insufficient observations, resulting in an ultimate dataset of 2002 groups. The bias-correction algorithm successfully converges after three iterations. Standard errors are in parentheses, and significance levels are reported, along with *p*-values for diagnostic tests (AR(1), AR(2), Sargan overidentification test, and Hansen statistic).
***$p < 0.01$, **$p < 0.05$, and *$p < 0.1$.

among firms in BRIC countries. To observe heterogeneity within the study sample, we refer to Bagh et al. (2024) and Ezeani et al. (2023) and conduct a subsample analysis considering the variations across variables.

In Table 8, we see that the coefficient value is highest in the case of Chinese firms; the effect of FF on FRT is pronounced more, indicating that firms in China are more inclined to take risks when endowed with greater FF. This finding aligns with China's rapid economic

TABLE 6 Group regression: using industry- and year-adjusted median.

	Financial flexibility > median = 1		Financial flexibility < median = 0	
Variables	Direct effect FRT (1)	Moderating effect FRT (2)	Direct effect FRT (3)	Moderating effect FRT (4)
FF	0.329*** (0.104)	0.318*** (0.134)	−0.126 (0.091)	−0.202 (0.130)
INVEFF		0.078*** (0.033)		0.101 (0.073)
FF*INVEFF		0.082** (0.041)		0.064 (0.042)
Constant	1.721*** (0.229)	1.420*** (0.323)	0.210 (0.160)	1.221*** (0.173)
Controls	Yes	Yes	Yes	Yes
Year [FE]	Yes	Yes	Yes	Yes
Firm [FE]	Yes	Yes	Yes	Yes
No. of obs.	12,995	12,995	7014	7014
R-squared	0.232	0.251	0.093	0.119

Notes: This table reports the effect of high versus low FF on FRT by grouping the data using the binary variable threshold, derived from industry- and year-adjusted median of financial flexibility. This division enables the examination of a potential threshold effect, comparing the impact of financial flexibility on the ERT between higher (Threshold = 1) and lower (Threshold = 0) levels. To investigate this hypothesis, we incorporate binary dummy variable (Threshold) classified samples into two groups based on higher (Threshold = 1) and lower (Threshold = 0) FF to provide insights into the effect of FF on FRT. We aim to explore potential high versus low patterns and capture the complexities inherent in relationships between the variables. Robust standard errors are reported in parentheses.
***$p < 0.01$, **$p < 0.05$, and *$p < 0.1$.

TABLE 7 Fixed effect robust: a pre-pandemic, during, and post-pandemic analysis.

	Covid (pre)		Covid		Covid (post)	
Variables	(1) FRT	(2) FRT	(3) FRT	(4) FRT	(5) FRT	(6) FRT
FF	0.201*** (0.043)	0.199*** (0.042)	0.051 (0.034)	0.049 (0.026)	0.154*** (0.061)	0.152*** (0.072)
INVEFF		0.043*** (0.012)		0.036** (0.018)		0.040** (0.020)
FF*INVEFF		0.039** (0.019)		0.023* (0.013)		0.024** (0.012)
Constant	1.001*** (0.221)	1.013*** (0.201)	1.207*** (0.360)	1.009*** (0.203)	1.807*** (0.105)	1.912*** (0.203)
Controls	Yes	Yes		Yes	Yes	Yes
Year [FE]	Yes	Yes		Yes	Yes	Yes
Firm [FE]	Yes	Yes		Yes	Yes	Yes
Observations	10,923	10,923	4513	4513	4573	4573
Adj. R^2	0.132	0.139	0.022	0.032	0.062	0.072

Notes: This table reports a robustness check using an alternative estimator considering primary analysis measures and with additional controls. Standard errors in parentheses.
***$p < 0.01$, **$p < 0.05$, and *$p < 0.1$.

growth, large market size, and supportive government policies fostering innovation and business development. The country's focus on innovation and technological advancement fosters a conducive environment for risk-taking. In contrast, in the case of Brazilian firms, the findings in column 1 show the lowest FF–FRT coefficient, reflecting challenges such as economic fluctuations and regulatory hurdles that potentially limit the effectiveness of FF in promoting FRT behaviors. Despite efforts to improve the business environment, political instability and regulatory hurdles remain constraints. In the case of India, column 3 shows a moderate positive effect of FF on FRT. India's

TABLE 8 Subsample analysis.

Variables	Brazil (1) FRT	Russia (2) FRT	India (3) FRT	China (4) FRT	Brazil (5) FRT	Russia (6) FRT	India (7) FRT	China (8) FRT
FF	0.103*** (0.031)	0.070** (0.035)	0.184*** (0.040)	0.253*** (0.101)	0.110*** (0.029)	0.075** (0.036)	0.189*** (0.045)	0.251*** (0.091)
INVEFF					0.085*** (0.022)	0.055*** (0.012)	0.195*** (0.033)	0.227*** (0.043)
FF*INVEFF					0.034*** (0.010)	0.023* (0.013)	0.088*** (0.021)	0.158*** (0.065)
Constant	0.167*** (0.111)	0.134** (0.066)	0.123*** (0.039)	0.153*** (0.091)	1.063*** (0.197)	0.199** (0.099)	0.154*** (0.050)	0.185*** (0.072)
Controls	Included	Included	Included	Included	Included	Included	Included	Included
Year [FE]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm [FE]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2504	3915	5187	8403	2504	3915	5187	8403
Adj. R^2	0.031	0.043	0.091	0.121	0.039	0.048	0.101	0.129

Notes: This table reports subsample analysis. Standard errors in parentheses.
***$p < 0.01$, **$p < 0.05$, and *$p < 0.1$.

economic growth and regulatory reforms support this positive influence, though challenges like bureaucracy and market inefficiencies remain. The moderating effect of INVEFF suggests that while FF is beneficial, the efficiency of investment decisions plays a crucial role in enhancing FRT behaviors. In column 2, in the case of the Russian firm, we see that FF contributes less, as indicated by the coefficient. This lower impact can be attributed to Russia's volatile economic conditions and a regulatory environment marked by significant political and financial risks, which diminish the positive influence of FF on FRT behavior.

Regarding the moderating effect of INVEFF, in Table 8, column 8, China again stands out with the highest moderating effects (FF*INVEFF in column 8), suggesting that efficient utilization of financial resources significantly enhances the FF–FRT relationship. Its mature financial markets and strategic economic policies reinforce this robust moderation in China, facilitating optimal FRT strategies. In contrast, Russia (column 2) and Brazil (column 1) demonstrate lower moderating effects, suggesting less pronounced impacts of INVEFF on FF-FRT dynamics. These disparities are attributed to volatile economic conditions, regulatory uncertainties, and varying levels of market development in these countries.

Overall, across the whole sample, the findings emphasize the importance of economic stability, supportive regulatory frameworks, and efficient financial strategies in enhancing the relationship between FF and FRT. The study's focus on BRIC markets provides valuable insights for investors and managers navigating diverse economic landscapes. By illuminating how these factors interact across different countries, the research contributes to a deeper understanding of how firms leverage FF amidst varying market conditions, thereby informing strategic decision-making and policy formulation in global business contexts.

4.7 | Robustness check

4.7.1 | Robustness check: Using feasible generalized least square

In our initial robustness check, we employ an alternative estimator, feasible generalized least square, to address CSD issues identified in our data through the CSD test (see Table A2). We examine the relationship between FF and FRT, considering the moderation by investment efficiency, holding onto primary analysis proxies. The results, presented in columns 1 and 2 of Table 9, confirm the robustness of our findings. Additionally, we extended the analysis by introducing additional controls, and the results in columns 3 and 4 of Table 6 consistently validate the robust nature of our results across alternative measures and estimators.

4.7.2 | Robustness check using alternative estimators, proxies, and additional controls

In the final robustness check in Table 10, holding onto the main proxy for FRT, FF, and INVEFF and departing from the main proxy for FRT, we use two alternative measures of FRT in arrangement with recent literature: (1) Z-score (Cao & Juelsrud, 2022; Nakano & Nguyen, 2012) and (2) R&D investment (Coles et al., 2006). In columns 4–6, we include the cash holding ratio as an alternative proxy of FF following Ma and Jin (2016) and adopt the model proposed by Chen et al. (2017) as a secondary measure to evaluate investment efficiency. Using the primary and alternative measures in columns 1–3, we present the estimates of the direct effect of FF on FRT. At the same time, we report estimates of the moderating effect of INVEFF in

TABLE 9 Robustness check: using feasible generalized least square.

Variables	Direct effect (1) FRT	Moderating effect (2) FRT	Direct effect (3) FRT	Moderating effect (4) FRT
FF	0.371*** (0.059)	0.351*** (0.064)	0.289*** (0.072)	0.258*** (0.074)
INVEFF		0.064** (0.032)		0.052** (0.026)
FF*INVEFF		0.039** (0.019)		0.041*** (0.017)
Firm Size	−0.022*** (0.008)	−0.034*** (0.013)	−0.023* (0.013)	−0.018** (0.009)
Leve	−0.041*** (0.015)	−0.036** (0.019)	−0.049** (0.025)	−0.043** (0.020)
Cash flow	−0.035*** (0.013)	−0.022** (0.011)	−0.009*** (0.003)	−0.010** (0.004)
LN Age	0.131*** (0.050)	0.123 (0.095)	0.124** (0.062)	0.128** (0.069)
KZ Index	−0.018** (0.009)	−0.021** (0.010)	−0.008** (0.004)	−0.013* (0.007)
Big 4	−0.005** (0.002)	−0.003 (0.003)	−0.004 (0.003)	−0.009*** (0.002)
HHI	−0.006 (0.004)	−0.016** (0.006)	−0.016 (0.011)	−0.019 (0.013)
INFLN	−0.051 (0.031)	−0.054 (0.039)		
GDP	0.015*** (0.002)	0.017*** (0.004)		
NL Board			0.025 (0.018)	0.038* (0.022)
Dual			0.002** (0.001)	0.009* (0.004)
Constant	1.213*** (0.321)	1.147*** (0.760)	1.109*** (0.223)	1.887*** (0.105)
Observations	20,009	20,009	19,868	19,868
Wald (prob.)	0.000	0.000	0.000	0.000

Note: This table reports a robustness check using an alternative estimator considering primary analysis measures and with additional controls: standard errors in parentheses.
***$p < 0.01$, **$p < 0.05$, and *$p < 0.1$.

columns 4–6. The findings confirm that the study's anticipated results are robust under the substitute measures.

4.8 | Discussion

In this study, we first examine the effect of FF on FRT. The study is evidence of a positive and statistically significant influence, supporting the study's primary hypothesis (H1). Second, we examine the moderation effect of INVEFF as a moderating factor in shaping the relationship between FF and FRT. The study documents that INVEFF significantly strengthens this relationship, and these outcomes affirm H2. Importantly, these patterns are consistent across fixed effect robust and HDFE, two-step system GMM, and BCMM models. Our research validates the positive correlation between FF and FRT; these findings agree with Chao and Huang (2022), Langenmayr and Lester (2018), and Liu and Chang (2020). INVEFF is a strengthening factor for FF, as indicated by Raza et al. (2021). High INVEFF signifies effective asset utilization, indicating organizational success (Chen et al., 2017). Studies emphasize the importance of INVEFF in enhancing intangible assets through R&D activities and innovation (Radicic & Alkaraan, 2022; Alkaraan, 2023).

The observed positive and significant effect of FF on FRT is rooted in well-established theoretical frameworks. The ROT highlights how FF enables firms to navigate uncertainties and capitalize on high-risk, high-return investment opportunities. The POT emphasizes that financially flexible firms equipped with internal funds are more inclined to retain control and be willing to engage in riskier ventures. Agency theory further supports this relationship, highlighting that FF can mitigate agency conflicts and align managerial decisions with

TABLE 10 Robustness check: Driscoll–Kraay standard errors.

	Direct effect			Moderating effect		
	Using main measures	Using alternative measures		Using main measures	Using alternative measures	
Variables	FRT (1)	Z-score (2)	R&D invest. (3)	FRT (4)	Z-score (5)	R&D invest. (6)
FF	0.213*** (0.052)	0.228** (0.111)	0.318*** (0.099)	0.221*** (0.002)	0.237*** (0.077)	0.295*** (0.101)
INVEFF				0.067*** (0.025)	0.101*** (0.043)	0.123* (0.073)
FF*INVEFF				0.042** (0.021)	0.105* (0.062)	0.106** (0.053)
Constant	3.095*** (0.139)	1.647*** (0.244)	4.621*** (0.594)	5.321*** (0.237)	1.803*** (0.152)	7.445*** (0.449)
Controls	Included	Included	Included	Included	Included	Included
Firm [FE]	Yes	Yes	Yes	Yes	Yes	Yes
Year [FE]	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	20,009	20,133	19,011	20,009	20,133	19,011
Sample period	2014–2023	2014–2023	2014–2023	2014–2023	2014–2023	2014–2023
R-squared	0.128	0.165	0.191	0.142	0.187	0.199
Prob > F	0.000	0.000	0.000	0.000	0.000	0.000

Notes: This table reports the second robustness check, holding onto the main proxy for FRT and FF results, which are presented in columns 1–3. Additionally, we explore alternative measures following recent literature: Z-score and R&D investment for FRT (Cao & Juelsrud, 2022; Coles et al., 2006; Nakano & Nguyen, 2012) and cash holding ratio defined as (FF) as used by Ma and Jin (2016). The results of the primary and alternative measures are reported in columns 4–6. We use Driscoll–Kraay standard errors for the alternative estimator.
***$p < 0.01$, **$p < 0.05$, and *$p < 0.1$.

shareholder interests (Jensen & Meckling, 1976). Additionally, within the dynamic capabilities' framework, FF is seen as a dynamic capability that allows firms to adapt and respond to evolving market conditions and fosters an inclination for FRT activities. This convergence of theoretical perspectives provides a comprehensive understanding of why FF influences firms to undertake more significant risks in their strategic endeavors.

The significant moderating role of INVEFF in the relationship between FF and firms' risk-taking finds theoretical support from various perspectives. First, INVEFF aligns with the RBV by emphasizing how effective resource allocation can enhance a firm's competitive advantage. Firms with high INVEFF are better positioned to strategically deploy their FF, resulting in more pronounced effects on FRT. Second, INVEFF resonates with the efficient market hypothesis by implying that firms make informed and value-maximizing investment decisions. For financially efficient firms, the moderating effect of INVEFF enhances the alignment between FF and FRT. In emerging markets, the inclusion of INVEFF as a mechanism shaping the relationship between FF and FRT is substantiated by its strategic significance in decision-making. Emerging market firms utilize their FF to explore diverse investment opportunities, emphasizing the pivotal role of effective resource allocation. A heightened level of investment efficiency, serving as a moderator, reinforces the positive impact of FF on FRT, enabling well-informed and value-maximizing investment decisions within the dynamic landscape of emerging markets. Conversely, a decline in INVEFF may impede effective allocation, hindering the realization of benefits and underscoring the unique challenges and opportunities in these markets. The findings substantiate the claim that FF contributes to the increased FRT of emerging markets (BRIC) and illustrate that INVEFF plays a reinforcing role in the FF and FRT association.

We also analyze the impact of COVID-19 as a shock by conducting pre-COVID, during COVID, and post-COVID period analyses. The findings suggest distinct differences in the effects of FF and INVEFF on FRT across these periods. Pre-COVID results show a strong positive impact of both FF and INVEFF on FRT, with a significant interaction effect. During the COVID period, the impact of FF on FRT becomes insignificant, while INVEFF continues to influence FRT, albeit with a weaker interaction effect positively. This indicates that firms relied more on INVEFF than FF during economic uncertainty to drive FRT behaviors. Post-COVID, the effects of both FF and INVEFF on FRT re-emerge strongly, with significant positive coefficients and a moderate interaction effect, indicating a return to the pre-COVID dynamics where both factors jointly enhance FRT. These variations highlight the importance of context, showing how external economic conditions influence the relative importance of FF and INVEFF in determining FRT behaviors.

Lastly, we conducted subsample analyses to understand the heterogeneity within the BRIC countries. The results reveal significant variances among these countries in the FF–FRT relationship. Chinese firms exhibit the highest FF–FRT coefficient, indicating a stronger inclination to take risks when endowed with greater FF. This aligns

with China's rapid economic growth, large market size, and supportive government policies fostering innovation and business development. Conversely, Brazilian firms show the lowest FF–FRT coefficient, reflecting challenges such as economic fluctuations and regulatory hurdles that limit the effectiveness of FF in promoting FRT behaviors. Indian firms exhibit a moderate positive effect of FF on FRT, supported by economic growth and regulatory reforms, although challenges like bureaucracy and market inefficiencies persist. Russian firms show a lower impact of FF on FRT, attributed to volatile economic conditions and significant political and economic risks.

Regarding the moderating effect of INVEFF, Chinese firms again stand out with the highest moderating effects, suggesting that efficient utilization of financial resources significantly enhances the FF–FRT relationship. This is reinforced by China's mature financial markets and strategic economic policies. In contrast, Russia and Brazil demonstrate lower moderating effects, attributed to volatile economic conditions, regulatory uncertainties, and varying levels of market development.

The robust estimations of this study affirm the significant influence of FF on firms' decisions, emphasizing their direct connection to FRT. This implies that strategic financial decision-makers should carefully balance FF to maintain a healthy level of FRT behavior. Recognizing the intricate relationship between financial resources and risk behavior, the study highlights the importance of maintaining a balanced FF. Corporate finance practitioners should strive for a moderate level of FF, understanding that while moderate flexibility fuels growth, excessive flexibility might necessitate caution, affecting firms' risk appetite and strategic decisions. The practical implications of these findings include developing strategies that enable firms to respond effectively in times of crisis while maintaining effective investment policies. The study contributes to theoretical understanding by revealing a critical linkage between the FF–FRT relationship enhancing financial literature with new insights into the link between FF and FRT in emerging market-listed firms.

Additionally, the introduction of robust estimations contributes to empirical research methodologies in finance. Our study findings are consistent with the idea that firms operating with a specific level of FF may possess a unique competitive advantage or an enhanced ability to take risks. Other factors, including institutional norms, cultural contexts, regulatory environments, stakeholder demands, and resource disparities, could contribute to the observed variations among firms.

5 | CONCLUSION

This study examined the effect of FF on FRT and the moderating role of INVEFF. Using a sample of 2301 firms across four emerging markets (BRIC), we employed static and dynamic panel data methods to uncover a positive impact of FF on FRT, aligning with theoretical expectations. INVEFF emerged as a significant moderator influencing the FF–FRT relationship. This highlights the necessity of maintaining a balanced FF for sound financial decision-making and the complex connection between financial resources and risk behavior. The study examined COVID-19's impact by analyzing pre-COVID, during COVID-19, and post-COVID periods. Findings show that pre-COVID, FF and INVEFF positively impacted FRT, with a strong interaction effect. During COVID-19, FF alone had no significant impact on FRT, while INVEFF continued to influence it positively, though weaker. Post-COVID, FF and INVEFF regained substantial positive impacts on FRT, with a moderate interaction effect, reflecting a return to pre-COVID dynamics. These results highlight how external economic conditions shape the roles of FF and INVEFF in influencing FRT behaviors.

Our subsample analysis revealed significant heterogeneity. Chinese firms showed the highest FF–FRT coefficient, reflecting a robust risk-taking tendency with greater FF, supported by rapid economic growth and favorable government policies. Conversely, Brazilian firms exhibited the lowest FF–FRT coefficient due to economic fluctuations and regulatory challenges. Indian firms demonstrated a moderate positive FF–FRT effect amid economic growth and reforms despite bureaucratic hurdles. Russian firms showed a weaker FF–FRT relationship, influenced by volatile economic conditions and regulatory risks. Regarding INVEFF moderation, China displayed the most substantial effects, indicating efficient financial resource use bolstered by mature financial markets and strategic policies. In contrast, Brazil and Russia showed weaker moderation, influenced by economic volatility and regulatory uncertainties.

5.1 | Economic significance and theoretical insights

The economic significance of the findings lies in demonstrating that FF is a critical driver of FRT, particularly in emerging markets. The positive impact of FF on FRT highlights the importance of maintaining sufficient cash reserves and low leverage to navigate uncertainties and capitalize on high-risk, high-return opportunities. The study also shows that investment INVEFF enhances this relationship, suggesting that firms with high INVEFF can better utilize their FF for strategic investments. This research advances our understanding by bridging gaps in existing literature. Previous studies have shown mixed results on the FF–FRT relationship, with some indicating positive effects, others finding nonlinear relationships, and a few reporting negative impacts. By focusing on emerging markets and employing robust panel data methods, this study provides more evident evidence of the positive link between FF and FRT. It also introduces INVEFF as a significant moderator, offering a new perspective on how firms can maximize the benefits of FF through efficient resource allocation.

The observed moderation by INVEFF finds theoretical backing from various perspectives. In line with the RBV, INVEFF accentuates how effective resource allocation enhances a firm's competitive advantage. Firms with high INVEFF strategically deploy FF, strengthening their impact on risk-taking. FF's positive and significant effect on firms' risk-taking is rooted in established theoretical frameworks. Fundamental options theory emphasizes FF's role in navigating

uncertainties and capitalizing on high-risk, high-return opportunities. POT underscores that financially flexible firms armed with internal funds are more likely to retain control and engage in riskier ventures. Agency theory further supports this, noting FF's potential to mitigate agency conflicts and align managerial decisions with shareholder interests. Our robustness tests ensure these findings' stability, reinforcing our results' consistency and reliability.

The contributions are threefold: First, the study emphasizes the critical role of FF in enhancing firms' strategic adaptability and resilience, particularly in volatile and uncertain environments characteristic of emerging markets. Second, it identifies INVEFF as a critical factor in strengthening the FF–FRT relationship. It provides a nuanced understanding of how firms can leverage their financial resources to drive growth and innovation. Third, our study also conducts country-wise analysis to provide more understanding across the panel. Moreover, this study uses robust methodology and performs different robustness checks. Our study insights will be valuable for managers, investors, and policymakers aiming to foster a more dynamic and resilient business environment in emerging economies.

5.2 | Policy implications

The findings have several practical implications for managers and investors, particularly in emerging markets. First, managers should prioritize maintaining a balanced level of FF to enhance their capacity for strategic decision-making. A strong FF allows firms to navigate uncertainties, capitalize on high-risk, high-return opportunities, and sustain competitive advantage. Effective FF management ensures that firms can allocate resources efficiently, even in volatile market conditions. This is crucial for sustaining long-term growth and resilience. Second, high IE enables firms to make well-informed investment decisions that maximize value. Managers should focus on improving INVEFF by optimizing resource allocation and investing in innovation and R&D. By enhancing INVEFF, firms can better leverage their FF to take calculated risks, thereby aligning their risk-taking behaviors with strategic goals and shareholder interests.

Third, regulatory bodies, financial institutions, and industry associations should promote awareness of the importance of FF among non-financial firms in emerging markets. Initiatives could include educational programs and workshops to highlight the benefits of FF and INVEFF. Governments and policymakers should consider offering incentives, such as tax benefits, to encourage firms to maintain adequate levels of FF. These incentives can motivate firms to engage in risk-taking behaviors that drive innovation and growth. Moreover, regulatory approaches should be adaptive, considering the dynamic nature of financial decision-making. Periodic reviews and updates of guidelines can help ensure they remain relevant to the evolving financial landscapes of emerging markets. Facilitating cross-border collaboration among firms can promote the exchange of best practices and harmonize regulatory frameworks, enhancing the overall economic ecosystem in emerging markets. Lastly, investors can use the insights from this study to identify firms with strong FF and high INVEFF as potential investment opportunities. Such firms will likely exhibit greater resilience and strategic adaptability, making them attractive investment prospects. Understanding the moderating role of INVEFF can help investors assess firms' risk profiles more accurately. Firms with high INVEFF are better positioned to leverage their FF for risk-taking, potentially leading to higher returns.

5.3 | Limitations and future avenues

While providing valuable insights, this study has limitations that warrant consideration. Firstly, focusing on a specific sample of 2301 firms across four emerging markets (BRIC) may constrain the generalizability of findings, potentially overlooking the diversity of financial landscapes in other emerging economies. Secondly, the use of static and dynamic panel data methods, while robust, is susceptible to biases and omitted variable issues, impacting result accuracy. The absence of an exogenous shock poses a challenge, as the study's exploration of cross-sectional cuts may not fully establish causality. Consequently, caution is advised when interpreting results as causal relationships.

Future research should explore more extensive cross-sectional variations to enhance causal inference. Moreover, while the study identifies INVEFF as a significant moderator, specific factors influencing it, particularly across diverse industries or sectors, remain underexplored. Considering institutional norms, cultural contexts, regulatory environments, stakeholder demands, and resource disparities could enrich the understanding of variations among firms in FF and risk-taking relationships.

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DATA AVAILABILITY STATEMENT

Data available on request from the authors.

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ENDNOTES

[1] Let us consider an example of how the formula for standard deviation of ROA is calculated over 3-year overlapping periods in this research paper. Assume we have annual return on assets (ROA) data for a company over 3 years. $ROA_{2012} = 0.968248$, $ROA_{2013} = 1.10296$, $ROA_{2014} = 0.979996$.

$$Mean\ ROA\ (\overline{X}) = \overline{X} = \frac{\sum_{i=1}^{n} ROA_i}{n} = \frac{ROA_{2012} + ROA_{2013} + ROA_{2014}}{3}$$

ROA values (past 3 years): $\frac{0.968248_{2012}+1.10296_{2013}+0.979996_{2014}}{3}=1.017401$

For each year, calculate the squared difference from the mean

$$=\left(ROA_i-\overline{X}\right)^2=(0.968248-1.017401)^2,(1.10296-1.017401)^2,(0.979996-1.017401)^2$$

For each year, average of squared differences with the mean

$$=\frac{\sum_{9=1}^{11}ROA_i}{n}$$

$$=\frac{(0.968248-1.017401)^2+(1.1029-1.0174)^2+(0.9799-1.0174)^2}{3}$$

$$=0.00215$$

$\sigma^2(Variance)=0.0021557$ (average of squared differences); thus, FRT for 2012 = σ 0.0464.

[2] In the first stage of system GMM, lagged dependent variables ERT serve as instruments to estimate coefficients of endogenous variables and to address potential endogeneity by capturing the influence of past values on current endogenous variables. In the second stage (difference GMM), the differenced equation is estimated, obtaining consistent estimates of fixed effects and other parameters. The inclusion of lagged dependent variables as instruments in the first stage enhances instrument validity, effectively addressing endogeneity and improving parameter estimate efficiency.

[3] We do not report OLS indicated by OLS post estimation, and these estimations are available on request.

[4] Both first- and second-generation unit root frameworks. ADF–Fisher is deemed suitable for unbalanced panel data, presuming complete cross-sectional independence. The second-generation PCIPS test addresses cross-sectional reliance, confirming the hypothesized order of integration.

[5] In the first stage of system GMM, lagged dependent variables ERT serve as instruments to estimate coefficients of endogenous variables and to address potential endogeneity by capturing the influence of past values on current endogenous variables. In the second stage (difference GMM), the differenced equation is estimated, obtaining consistent estimates of fixed effects and other parameters. The inclusion of lagged dependent variables as instruments in the first stage enhances instrument validity, effectively addressing endogeneity and improving parameter estimate efficiency.

[6] To save space, this study does not report Wilcoxon signed-rank tests or *t*-statistics; however, they are accessible upon request.

REFERENCES

Acharya, V. V., Amihud, Y., & Litov, L. (2011). Creditor rights and corporate risk-taking. *Journal of Financial Economics*, *102*(1), 150–166. https://doi.org/10.1016/j.jfineco.2011.04.001

Agoraki, K. K., Giaka, M., Konstantios, D., & Negkakis, I. (2024). The relationship between firm-level climate change exposure, financial integration, cost of capital and investment efficiency. *Journal of International Money and Finance*, *141*, 102994. https://doi.org/10.1016/j.jimonfin.2023.102994

Alkaraan, F. (2023). Editorial: Corporate governance and sustainability issues. *Corporate Governance and Sustainability Review*, *7*(1), 4–6. https://doi.org/10.22495/cgsrv7i1editorial

Almeida, H., & Campello, M. (2007). Financial constraints, asset tangibility, and corporate investment. *The Review of Financial Studies*, *20*(5), 1429–1460. https://doi.org/10.1093/rfs/hhm019

Arslan-Ayaydin, Ö., Florackis, C., & Ozkan, A. (2014). Financial flexibility, corporate investment and performance: evidence from financial crises. *Review of Quantitative Finance and Accounting*, *42*(2), 211–250. https://doi.org/10.1007/s11156-012-0340-x

Bagh, T., Zhou, B., Alawi, S. M., & Azam, R. I. (2024). ESG resilience: Exploring the non-linear effects of ESG performance on firms sustainable growth. *Research in International Business and Finance*, *70*, 102305. https://doi.org/10.1016/j.ribaf.2024.102305

Bancel, F., & Mittoo, U. R. (2011). Financial flexibility and the impact of the global financial crisis. *International Journal of Managerial Finance*, *7*(2), 179–216. https://doi.org/10.1108/17439131111122157

Bataineh, M. J., Sánchez-Sellero, P., & Ayad, F. (2023). Green is the new black: How research and development and green innovation provide businesses a competitive edge. *Business Strategy and the Environment*, *33*(2), 1004-1023. https://doi.org/10.1002/bse.3533

Baum, C. F., Caglayan, M., Ozkan, N., & Talavera, O. (2006). The impact of macroeconomic uncertainty on non-financial firms' demand for liquidity. *Review of Financial Economics*, *15*(4), 289–304. https://doi.org/10.1016/j.rfe.2006.01.002

Biddle, G. C., Hilary, G., & Verdi, R. S. (2009). How does financial reporting quality relate to investment efficiency? *Journal of Accounting and Economics*, *48*(2), 112–131. https://doi.org/10.1016/j.jacceco.2009.09.001

Bilyay-Erdogan, S. (2020). Does financial flexibility enhance firm value? A comparative study between developed and emerging countries. *Business: Theory and Practice*, *21*(2), 723–736. https://doi.org/10.3846/btp.2020.12680

Black, F., & Scholes, M. (1974). The effects of dividend yield and dividend policy on common stock prices and returns. *Journal of Financial Economics*, *1*(1), 1–22. https://doi.org/10.1016/0304-405X(74)90006-3

Borio, C. (2014). The financial cycle and macroeconomics: What have we learnt? *Journal of Banking & Finance*, *45*, 182–198. https://doi.org/10.1016/j.jbankfin.2013.07.031

Bowman, E. H. (1984). Content analysis of annual reports for corporate strategy and risk. *Interfaces*, *14*(1), 61–71. https://doi.org/10.1287/inte.14.1.61

Breitung, J., Kripfganz, S., & Hayakawa, K. (2022). Bias-corrected method of moments estimators for dynamic panel data models. *Econometrics and Statistics*, *24*, 116–132. https://doi.org/10.1016/j.ecosta.2021.07.001

Bromiley, P. (1991). Testing a causal model of corporate risk taking and performance. *Academy of Management Journal*, *34*(1), 37–59. https://doi.org/10.5465/256301

Cao, J., & Juelsrud, R. E. (2022). Opacity and risk-taking: Evidence from Norway. *Journal of Banking & Finance*, *134*, 106010. https://doi.org/10.1016/j.jbankfin.2020.106010

Cao, Y., Dong, Y., Lu, Y., & Ma, D. (2020). Does institutional ownership improve firm investment efficiency? *Emerging Markets Finance and Trade*, *56*(12), 2772–2792. https://doi.org/10.1080/1540496X.2018.1486705

Cao, Y., Dong, Y., Ma, D., & Sun, L. (2021). Customer concentration and corporate risk-taking. *Journal of Financial Stability*, *54*, 100890. https://doi.org/10.1016/j.jfs.2021.100890

Chang, B.-G., & Wu, K.-S. (2021). The nonlinear relationship between financial flexibility and enterprise risk-taking during the COVID-19 pandemic in Taiwan's semiconductor industry. *Oeconomia Copernicana*, *12*(2), 307–333. https://doi.org/10.24136/oc.2021.011

Chang, B.-G., & Wu, K.-S. (2022). Concave effect of financial flexibility on semiconductor industry performance: Quantile regression approach. *Technological and Economic Development of Economy*, *28*(4), 948–978. https://doi.org/10.3846/tede.2022.16622

Chao, C.-H., & Huang, C.-J. (2022). Firm performance following actual share repurchases: Effects of investment crowding out and financial flexibility. *Pacific-Basin Finance Journal*, *73*, 101738. https://doi.org/10.1016/j.pacfin.2022.101738

Chen, F., Hope, O.-K., Li, Q., & Wang, X. (2011). Financial reporting quality and investment efficiency of private firms in emerging markets. *The*

Accounting Review, *86*(4), 1255–1288. https://doi.org/10.2308/accr-10040

Chen, N., Sung, H.-C., & Yang, J. (2017). Ownership structure, corporate governance and investment efficiency of Chinese listed firms. *Pacific Accounting Review*, *29*(3), 266–282. https://doi.org/10.1108/PAR-12-2015-0046

Chen, Z., Du, J., Li, D., & Ouyang, R. (2013). Does foreign institutional ownership increase return volatility? Evidence from China. *Journal of Banking & Finance*, *37*(2), 660–669. https://doi.org/10.1016/j.jbankfin.2012.10.006

Coles, J. L., Daniel, N. D., & Naveen, L. (2006). Managerial incentives and risk-taking. *Journal of Financial Economics*, *79*(2), 431–468. https://doi.org/10.1016/j.jfineco.2004.09.004

Cucculelli, M., & Ermini, B. (2013). Risk attitude, product innovation, and firm growth. Evidence from Italian manufacturing firms. *Economics Letters*, *118*(2), 275–279. https://doi.org/10.1016/j.econlet.2012.11.006

Demerjian, P., Lewis-Western, M., & McVay, S. (2020). How does intentional earnings smoothing vary with managerial ability? *Journal of Accounting, Auditing and Finance*, *35*(2), 406–437. https://doi.org/10.1177/0148558X17748405

Denis, D. J. (2011). Financial flexibility and corporate liquidity. *Journal of Corporate Finance*, *17*(3), 667–674. https://doi.org/10.1016/j.jcorpfin.2011.03.006

Denis, D. J., & McKeon, S. B. (2012). Debt financing and financial flexibility evidence from proactive leverage increases. *The Review of Financial Studies*, *25*(6), 1897–1929. https://doi.org/10.1093/rfs/hhs005

Díez-Esteban, J. M., García-Gómez, C. D., López-Iturriaga, F. J., & Santamaría-Mariscal, M. (2017). Corporate risk-taking, returns and the nature of major shareholders: Evidence from prospect theory. *Research in International Business and Finance*, *42*, 900–911. https://doi.org/10.1016/j.ribaf.2017.07.025

Eisenhardt, K. M. (1989). Agency theory: An assessment and review. *Academy of Management Review*, *14*(1), 57–74. https://doi.org/10.5465/amr.1989.4279003

Ezeani, E., Kwabi, F., Salem, R., Usman, M., Alqatamin, R. M. H., & Kostov, P. (2023). Corporate board and dynamics of capital structure: Evidence from UK, France and Germany. *International Journal of Finance and Economics*, *28*(3), 3281–3298. https://doi.org/10.1002/ijfe.2593

Faccio, M., Marchica, M.-T., & Mura, R. (2016). CEO gender, corporate risk-taking, and the efficiency of capital allocation. *Journal of Corporate Finance*, *39*, 193–209. https://doi.org/10.1016/j.jcorpfin.2016.02.008

Fama, E. F., & MacBeth, J. D. (1973). Risk, return, and equilibrium: Empirical tests. *Journal of Political Economy*, *81*(3), 607–636. https://doi.org/10.1086/260061

Fazzari, S., Hubbard, R. G., & Petersen, B. C. (1987). Financing constraints and corporate investment. National Bureau of Economic Research. https://doi.org/10.3386/w2387

Gamba, A., & Triantis, A. (2008). The value of financial flexibility. *The Journal of Finance*, *63*(5), 2263–2296. https://doi.org/10.1111/j.1540-6261.2008.01397

Gao, X., Xu, W., Li, D., & Xing, L. (2021). Media coverage and investment efficiency. *Journal of Empirical Finance*, *63*, 270–293. https://doi.org/10.1016/j.jempfin.2021.07.002

Ghabri, Y. (2022). Legal protection systems, corporate governance and firm performance: A cross-country comparison. *Studies in Economics and Finance*, *39*(2), 256–278. https://doi.org/10.1108/SEF-09-2021-0404

Gu, Y., & Yuan, F. (2020). Internal control, financial flexibility and corporate performance – Based on empirical analysis of listed companies in information technology industry. *Journal of Physics: Conference Series*, *1607*(1), 012118. https://doi.org/10.1088/1742-6596/1607/1/012118

Habib, A., & Hasan, M. M. (2017). Firm life cycle, corporate risk-taking and investor sentiment. *Accounting and Finance*, *57*(2), 465–497. https://doi.org/10.1111/acfi.12141

Hao, Z., Zhang, X., & Wei, J. (2022). Research on the effect of enterprise financial flexibility on sustainable innovation. *Journal of Innovation & Knowledge*, *7*(2), 100184. https://doi.org/10.1016/j.jik.2022.100184

Hu, J., Li, K., Xia, Y., & Zhang, J. (2023). Gender diversity and financial flexibility: Evidence from China. *International Review of Financial Analysis*, *90*, 102934. https://doi.org/10.1016/j.irfa.2023.102934

Huang, G., An, Z., & Li, D. (2023). Foreign institutional ownership and corporate risk-taking: International evidence. *Corporate Governance: An International Review*, *31*(2), 260–284. https://doi.org/10.1111/corg.12456

Hunjra, A. I., Bagh, T., Palma, A., & Goodell, J. W. (2024). Is enterprise risk-taking less sensitive to financial flexibility post COVID-19? Evidence from non-linear patterns. *International Review of Financial Analysis*, *95*, 103432. https://doi.org/10.1016/j.irfa.2024.103432

Iftikhar, K., Bagh, T., & Khan, M. A. (2024). The role of corporate governance in the nexus between litigation risk and corporate innovation. *Borsa Istanbul Review*, *24*, 732–746. https://doi.org/10.1016/j.bir.2024.04.005

Islam, M., Wang, M., & Dewri, L. (2019). Financial flexibility-A synthesis of literature review. *International Journal of Accounting and Financial Reporting*, *9*(1), 245–256. https://doi.org/10.1108/JAMR-06-2017-007

Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, *3*(4), 305–360. https://doi.org/10.1016/0304-405X(76)90026-X

John, K., Litov, L., & Yeung, B. (2008). Corporate governance and risk-taking. *The Journal of Finance*, *63*(4), 1679–1728. https://doi.org/10.1111/j.1540-6261.2008.01372

Juodis, A., & Reese, S. (2021). The Incidental Parameters Problem in Testing for Remaining Cross-Section Correlation. *Journal of Business & Economic Statistics*, *40*(3), 1191–1203. https://doi.org/10.1080/07350015.2021.1906687

Kanga, D., Murinde, V., & Soumaré, I. (2020). Capital, risk and profitability of WAEMU banks: Does bank ownership matter? *Journal of Banking & Finance*, *114*, 105814. https://doi.org/10.1016/j.jbankfin.2020.105814

Kini, O., & Williams, R. (2012). Tournament incentives, firm risk, and corporate policies. *Journal of Financial Economics*, *103*(2), 350–376. https://doi.org/10.1016/j.jfineco.2011.09.005

Kopyrina, O., Wu, K., & Ying, Z. (2023). Greening through central inspection: The role of legitimacy pressure and risk-taking. *Pacific-Basin Finance Journal*, *77*, 101894. https://doi.org/10.1016/j.pacfin.2022.101894

Kuo, Y.-F., Lin, Y.-M., & Chien, H.-F. (2021). Corporate social responsibility, enterprise risk management, and real earnings management: Evidence from managerial confidence. *Finance Research Letters*, *41*, 101805. https://doi.org/10.1016/j.frl.2020.101805

Langenmayr, D., & Lester, R. (2018). Taxation and corporate risk-taking. *The Accounting Review*, *93*(3), 237–266. https://doi.org/10.2308/accr-51872

Leahy, J. V., & Whited, T. M. (1995). The effect of uncertainty on investment: Some stylized facts. National Bureau of Economic Research Working Paper Series, No. 4986. https://doi.org/10.3386/w4986

Li, K., Griffin, D., Yue, H., & Zhao, L. (2013). How does culture influence corporate risk-taking? *Journal of Corporate Finance*, *23*, 1–22. https://doi.org/10.1016/j.jcorpfin.2013.07.008

Li, R., Cui, Y., & Zheng, Y. (2021). The impact of corporate strategy on enterprise innovation based on the mediating effect of corporate risk-taking. *Sustainability*, *13*(3), 1023. https://www.mdpi.com/2071-1050/13/3/1023. https://doi.org/10.3390/su13031023

Liu, C., & Wu, Y. W. (2023). Gender diversity and bank risk-taking: Female directors and executives. *Managerial Finance*, *49*(5), 761–788. https://doi.org/10.1108/MF-01-2022-0059

Liu, Y., & Chang, Y. (2020). The impact of financial flexibility on enterprise risk-taking. 1st Africa-Asia Dialogue Network (AADN) International Conference (AADNIC 2019).

López-Gamero, M. D., & Molina-Azorín, J. F. (2016). Environmental management and firm competitiveness: The joint analysis of external and internal elements. *Long Range Planning*, *49*(6), 746–763. https://doi.org/10.1016/j.lrp.2015.12.002

Low, A. (2009). Managerial risk-taking behavior and equity-based compensation. *Journal of Financial Economics*, *92*(3), 470–490. https://doi.org/10.1016/j.jfineco.2008.05.004

Ma, C.-A., & Jin, Y. (2016). What drives the relationship between financial flexibility and firm performance: Investment scale or investment efficiency? Evidence from China. *Emerging Markets Finance and Trade*, *52*(9), 2043–2055. https://doi.org/10.1080/1540496X.2015.1098036

Marchica, M.-T., & Mura, R. (2010). Financial flexibility, investment ability, and firm value: Evidence from firms with spare debt capacity. *Financial Management*, *39*(4), 1339–1365. https://doi.org/10.1111/j.1755-053X.2010.01115.x

Mbanyele, W., & Muchenje, L. T. (2022). Climate change exposure, risk management and corporate social responsibility: Cross-country evidence. *Journal of Multinational Financial Management*, *66*, 100771. https://doi.org/10.1016/j.mulfin.2022.100771

Menshawy, I. M., Basiruddin, R., Mohd-Zamil, N.-A., & Hussainey, K. (2021). Strive towards investment efficiency among Egyptian companies: Do board characteristics and information asymmetry matter? *International Journal of Finance and Economics*, *28*(3), 2382-2403. https://doi.org/10.1002/ijfe.2540

Miller, M. H., & Modigliani, F. (1963). Dividend policy and market valuation: A reply. *The Journal of Business*, *36*(1), 116–119. http://www.jstor.org/stable/2350461. https://doi.org/10.1086/294562

Minh, H. N., & Vinh, H. L. (2022). Impact of the Covid-19 pandemic on the risk-taking behavior of non-financial firms listed in vietnam with cash holdings as a moderating variable. *Journal of Eastern European and Central Asian Research*, *9*(3), 462–470. https://doi.org/10.15549/jeecar.v9i3.849

Mishra, D. R. (2024). Risk-taking incentives and risk-talking outcomes. *Journal of Banking & Finance*, *160*, 107080. https://doi.org/10.1016/j.jbankfin.2023.107080

Myers, S. C. (1984). Capital structure puzzle. National Bureau of Economic Research Working Paper Series, No. 1393. https://doi.org/10.3386/w1393

Myers, S. C. (2003). Chapter 4 – Financing of corporations. In G. M. Constantinides, M. Harris, & R. M. Stulz (Eds.), *Handbook of the economics of finance* (Vol. 1, pp. 215–253). Elsevier. https://doi.org/10.1016/S1574-0102(03)01008-2

Naeem, K., & Li, M. C. (2019). Corporate investment efficiency: The role of financial development in firms with financing constraints and agency issues in OECD non-financial firms. *International Review of Financial Analysis*, *62*, 53–68. https://doi.org/10.1016/j.irfa.2019.01.003

Nakano, M., & Nguyen, P. (2012). Board size and corporate risk taking: Further evidence from Japan. *Corporate Governance: An International Review*, *20*(4), 369–387. https://doi.org/10.1111/j.1467-8683.2012.00924

Naseer, M. M., Khan, M. A., Bagh, T., Guo, Y., & Zhu, X. (2024). Firm climate change risk and financial flexibility: Drivers of ESG performance and firm value. *Borsa Istanbul Review*, *24*(1), 106–117. https://doi.org/10.1016/j.bir.2023.11.003

Opler, T., Pinkowitz, L., Stulz, R., & Williamson, R. (1999). The determinants and implications of corporate cash holdings. *Journal of Financial Economics*, *52*(1), 3–46. https://doi.org/10.1016/S0304-405X(99)00003-3

Palmer, T. B., & Wiseman, R. M. (1999). Decoupling risk taking from income stream uncertainty: A holistic model of risk. *Strategic Management Journal*, *20*(11), 1037–1062. https://doi.org/10.1002/(SICI)1097-0266(199911)20:11<1037::AID-SMJ67>3.0.CO;2-2

Panousi, V., & Papanikolaou, D. (2012). Investment, idiosyncratic risk, and ownership. *The Journal of Finance*, *67*(3), 1113–1148. https://doi.org/10.1111/j.1540-6261.2012.01743.x

Pesaran, M. H. (2015). *Time Series and Panel Data Econometrics*. Oxford University Press. https://books.google.co.uk/books?id=5jITDAAAQBAJ

Pesaran, M. H. (2021). General diagnostic tests for cross-sectional dependence in panels. *Empirical Economics*, *60*(1), 13-50. https://doi.org/10.1007/s00181-020-01875-7

Phan, D. H. B., Iyke, B. N., Sharma, S. S., & Affandi, Y. (2021). Economic policy uncertainty and financial stability–Is there a relation? *Economic Modelling*, *94*, 1018–1029. https://doi.org/10.1016/j.econmod.2020.02.042

Radicic, D., & Alkaraan, F. (2022). Relative effectiveness of open innovation strategies in single and complex SME innovators. *Technology Analysis & Strategic Management*, 1–14. https://doi.org/10.1080/09537325.2022.2130042

Raza, A., Hamid, K., Sajid, M., & Rasheed, A. (2021). Mediating and moderating role of investment efficiency and investment scale between financial flexibility and firm performance. *International Journal of Management (IJM)*, *12*(4), 658–672. https://doi.org/10.34218/IJM.12.4.2021.056

Saeed, A., & Sameer, M. (2017). Impact of board gender diversity on dividend payments: Evidence from some emerging economies. *International Business Review*, *26*(6), 1100–1113. https://doi.org/10.1016/j.ibusrev.2017.04.005

Shahzad, F., Lu, J., & Fareed, Z. (2019). Does firm life cycle impact corporate risk taking and performance? *Journal of Multinational Financial Management*, *51*, 23–44. https://doi.org/10.1016/j.mulfin.2019.05.001

Shapiro, S. P. (2005). Agency theory. *Annual Review of Sociology*, *31*, 263–284. http://www.jstor.org/stable/29737720. https://doi.org/10.1146/annurev.soc.31.041304.122159

Smieja, J., Zaleskiewicz, T., Sobkow, A., & Traczyk, J. (2023). Imagining risk taking: The valence of mental imagery is related to the declared willingness to take risky actions. *Journal of Behavioral Decision Making*, *36*(4), e2340. https://doi.org/10.1002/bdm.2340

Stein, J. C. (2003). Chapter 2 – Agency, information and corporate investment. In G. M. Constantinides, M. Harris, & R. M. Stulz (Eds.), *Handbook of the economics of finance* (Vol. 1, pp. 111–165). Elsevier. https://doi.org/10.1016/S1574-0102(03)01006-9

Tang, H.-W., & Chang, C.-C. (2024). CEO overconfidence, risk-taking, and firm value: Influence of incentive compensation and financial constraints. *The North American Journal of Economics and Finance*, *69*, 102034. https://doi.org/10.1016/j.najef.2023.102034

Teng, X., Chang, B.-G., & Wu, K.-S. (2021). The role of financial flexibility on enterprise sustainable development during the COVID-19 crisis—A consideration of tangible assets. *Sustainability*, *13*(3), 1245. https://doi.org/10.3390/su13031245

Tran, Q. T. (2020). Foreign ownership and investment efficiency: New evidence from an emerging market. *International Journal of Emerging Markets*, *15*(6), 1185–1199. https://doi.org/10.1108/IJOEM-07-2019-0573

Trigeorgis, L., & Reuer, J. J. (2017). Real options theory in strategic management. *Strategic Management Journal*, *38*(1), 42–63. https://doi.org/10.1002/smj.2593

Ullah, I., Majeed, M. A., & Fang, H.-X. (2021). Female CEOs and corporate investment efficiency: Evidence from China. *Borsa Istanbul Review*, *21*(2), 161–174. https://doi.org/10.1016/j.bir.2020.09.010

Wu, W., Alkaraan, F., & Le, C. (2023). The moderating effects of corporate governance and investment efficiency on the nexus between financial

flexibility and firm performance. *Journal of Financial Reporting and Accounting*, ahead-of-print. https://doi.org/10.1108/JFRA-05-2023-0234

Zhang, H., & Geng, Q. (2018). Management ownership, financial flexibility and corporate risk-taking. *Finance and Accounting Monthly*, *2*, 85–93.

Zhou, L., Guo, N., Zhou, Z., & Zeng, H. (2020). The impact of corporate social responsibility and financial flexibility on risk. *Finance and Accounting Monthly*, *14*, 58–68. https://doi.org/10.19641/j.cnki.42-1290/f.2020.14.008

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APPENDIX A

TABLE A1 Panel unit root test estimations.

Framework Variables	First generation ADF–Fisher Statistics	Second generation PCIPS Statistics
FRT	−16.101***	−23.423***
FF	−21.502***	−51.845***
INVEFF	−12.832***	−15.543***
Firm Size	−9.111	−9.448***
Leve	−14.532***	−32.934
Cash flow	−23.281	−8.554***
LN Age	−14.012	−4.203
KZ Index	−21.324***	−2.304***
Big 4	3.132***	−7.012
HHI	−5.121	−4.823***
INFLN	−9.234***	−6.524
GDP	−23.313***	−16.832***

Notes: This table summarizes stationarity test results using first- and second-generation unit root frameworks. ADF–Fisher is deemed suitable for unbalanced panel data, presuming complete cross-sectional independence. The second-generation PCIPS test addresses cross-sectional reliance, confirming the hypothesized order of integration. ***$p < 0.01$, **$p < 0.05$, and *$p < 0.1$.

TABLE A2 Testing for weak cross-sectional dependence (CSD).

	CD	CDw	CDw+	CD*
FRT	186.820	−1.660	1.20e + 06	34.980
	(0.000)	(0.096)	(0.000)	(0.000)

Notes: This table presents the outcomes of testing for weak cross-sectional dependence (CSD), with *p*-values shown in parentheses. The tests refer to CD: Pesaran (2015, 2021), CDw: Juodis and Reese (2021), and CD*: Pesaran and Xie (2021) with four principal components. The analysis acknowledges an unbalanced panel, prompting test adjustments, and missing values are imputed for CD*. Each test seems to provide evidence supporting the presence of cross-sectional dependence in the panel data.