The dual high phenomenon and corporate innovation capabilities: Empirical evidence from Chinese textile enterprises

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ABSTRACT – REZUMAT

The dual high phenomenon and corporate innovation capabilities: Empirical evidence from Chinese textile enterprises

"Dual high" describes a situation where a firm simultaneously holds a high proportion of monetary funds and a high proportion of short-term loans. Using a sample of 1,796 textile companies in China, this paper explores the impact of the dual high phenomenon on a firm's innovation capabilities. The study finds that the more pronounced the dual high characteristics of a firm, the stronger the inhibitory effect on its innovation capabilities. The underlying mechanisms suggest that dual high characteristics increase financial risk, leading firms to reduce R&D investment to mitigate these risks, thereby inhibiting innovation. Moreover, digitalisation significantly moderates the relationship between the dual-high phenomenon and innovation capabilities, implying that a higher level of digitalisation reduces the adverse effects of dual high characteristics on innovation capabilities of Chinese textile enterprises. Further analysis shows that non-state-owned enterprises experience a stronger inhibitory effect on innovation capabilities compared to state-owned enterprises. Additionally, the lower the proportion of digitalisation in a firm, the stronger the inhibitory effect of dual high characteristics on innovation capabilities. This research enriches the theoretical understanding of the dual high phenomenon and provides practical insights for mitigating its negative impacts.

Keywords: *Dual High, short-term borrowings, monetary funds, corporate innovation, corporate financial risk, digitalisation*

Fenomenul "dual high" și capacitățile de inovare ale întreprinderilor: dovezi empirice din întreprinderile textile din China

Fenomenul „dual high" descrie o situație în care o firmă deține simultan o proporție mare de fonduri monetare și o proporție mare de împrumuturi pe termen scurt. Folosind un eșantion de 1.796 de companii textile din China, această lucrare explorează impactul fenomenului „dual high" asupra capacităților de inovare ale unei firme. Studiul constată că, cu cât caracteristicile „dual high" ale unei firme sunt mai pronunțate, cu atât efectul inhibitor asupra capacităților sale de inovare este mai puternic. Mecanismele care stau la baza acesteia sugerează că aceste caracteristici „dual high" cresc riscul financiar, determinând firmele să reducă investițiile în cercetare și dezvoltare pentru a atenua aceste riscuri, inhibând astfel inovarea. Mai mult, digitalizarea moderează semnificativ relația dintre fenomenul „dual high" și capacitățile de inovare, ceea ce implică faptul că un nivel mai ridicat de digitalizare reduce efectele adverse ale caracteristicilor „dual high" asupra capacităților de inovare ale întreprinderilor textile din China. Analizele ulterioare arată că întreprinderile private experimentează un efect inhibitor mai puternic asupra capacităților de inovare în comparație cu întreprinderile de stat. În plus, cu cât proporția de digitalizare este mai mică într-o firmă, cu atât efectul inhibitor al caracteristicilor „dual high" asupra capacităților de inovare este mai puternic. Această cercetare îmbogățește înțelegerea teoretică a fenomenului „dual high" și oferă perspective practice pentru atenuarea impactului său negativ.

Cuvinte-cheie*: „Dual High" , împrumuturi pe termen scurt, fonduri monetare, inovare corporativă, risc financiar corporativ, digitalizare*

INTRODUCTION

The report of the 20th National Congress of the Communist Party of China emphasised the need to strengthen and improve modern financial regulation and enhance the economic stability guarantee system. Before 2017, dual high was considered a sign of low capital utilisation efficiency. However, recent scandals involving dual high firms, such as Kangde Xin and Kangmei Pharmaceutical, have brought this phenomenon into the spotlight, turning it into a red flag for investors and negatively impacting these firms' reputations and growth [1]. In September 2023, President Xi Jinping introduced the concept of "new productive forces" during an inspection in Heilongjiang, which was further defined in January 2024 to emphasise innovation, quality, and the representation of advanced productive forces. Innovation capability is a key factor in a firm's sustainable development and relies heavily on consistent and sufficient cash flow to support both innovation input and output [2]. Firms with pronounced dual high characteristics are vulnerable to cash flow shortages as they allocate substantial monetary funds to repay short-term debts, thereby undermining the sustainability of their cash flows. Consequently, the more pronounced a

firm's dual high characteristics, the stronger the potential inhibitory effect on its innovation capability.

The textile industry is a cornerstone of China's economy, contributing nearly 7% of the country's GDP and accounting for approximately 35% of global textile exports. Given its massive scale, the industry faces significant pressure to innovate while managing the financial risks and ensuring a strong liquidity position. Explaining how financial constraints could impact innovation in this sector, particularly in a rapidly digitalising environment, can offer crucial insights for policymakers to enhance the sustainability and competitiveness of Chinese textile enterprises. The "dual high" phenomenon results from two types of factors: superficial and substantive [3]. Superficial factors do not pose economic consequences, and they are mainly observed in capital-intensive firms, which require large cash reserves for daily operations while borrowing externally [4, 5]. On the other hand, substantive factors are those leading to significant economic consequences. Firms may hold substantial non-liquid cash or other monetary funds that cannot be used freely, resulting in large interest-bearing debts [6]. Additionally, significant amounts of cash held by major shareholders or other parties also exacerbate the dual high situation [7]. When firms do not manage their cash holdings and short-term borrowings efficiently, they risk not allocating resources in alignment with sustainability requirements. This can be explained by the fact that when firms maintain a high ratio of cash holdings and short-term borrowings, most of the cash remains outside of business operations. This scenario may result in fewer resources being allocated to innovation capabilities, thereby compromising their sustainability goals.

Innovation capability is a critical measure of a firm's sustainable development, reflected in both innovation input and output. Sustained and ample cash flow is essential to support the R&D activities and innovation capabilities of firms [8]. However, firms with pronounced dual high characteristics are prone to cash flow shortages because they allocate substantial monetary funds to repay short-term debts. This dynamic undermines the sustainability of cash flows and inhibits their ability to innovate. The inhibitory effects of dual high characteristics on innovation capabilities can be explained through the lens of financial risk theory, which posits that a high level of debt increases a firm's financial risk, necessitating a more conservative approach to resource allocation [9]. Firms that are unable to manage their cash holdings and short-term borrowings experience high financial risks, and to mitigate these risks, they reduce their R&D investments, thereby limiting their innovative capability. This risk-averse behaviour is particularly pronounced in firms with high short-term debt obligations, as they prioritise liquidity management over long-term strategic investments.

Despite extensive research on the dual high phenomenon, the majority of previous literature has focused on its causes and governance strategies, leaving a significant gap in understanding the economic consequences, particularly regarding firm-level innovation capabilities. For example, Lian and Xu [3] examined factors resulting in dual high characteristics but did not explain their connection with innovation. In the same stride, Ma [5] investigate governance strategies to mitigate risks associated with dual high firms, but does not present their potential link with innovation capabilities. Studies on financing constraints and corporate innovation, such as Brown and Fazzari [10] and Aghion and Bloom [11], mainly focused on external financing difficulties rather than internal financial mismanagement framed by the dual high phenomenon. Additionally, prior literature on state-owned enterprises (SOEs) and non-state-owned enterprises (non-SOEs) examined the connection between performance and governance [12], completely ignoring the potential impact of the dual high phenomenon on innovation capabilities.

Furthermore, the role of digitalisation to mitigate financial constraints and promote innovation, explained by Brynjolfsson and McAfee [13] and Hanelt and Bohnsack [14], has not been linked to dual high context. Thus, this study fills these gaps by examining the impact of dual high phenomenon on innovation capabilities and showing the moderating effects of digitalisation and ownership structure.

There are numerous contributions presented by this paper. First, this paper extends research on the economic consequences of the dual high phenomenon in firms with a focus on their innovation capabilities. This paper, under the backdrop of new productive forces, examines how the dual high phenomenon could be linked to the innovation capabilities of textile enterprises of China, and thus enriches the understanding of the economic consequences of China's textile industry. Second, this paper complements economic research related to corporate innovation by incorporating the moderating effects of financial risk in the nexus between the dual-high phenomenon and corporate innovation capabilities. Current literature exclusively explains the factors affecting innovation from technological perspectives. However, it remains unexplored how financial aspects related to the dual high phenomenon could influence corporate innovation. Third, this study shows that digitalisation significantly moderates the nexus between the dual-high phenomenon and corporate innovation capabilities, showing that high levels of digitalisation in Chinese textile enterprises may reduce the adverse effects of dual high characteristics on innovation capabilities. The interaction between dual high and digitalisation underscores the potential for digitalisation to foster innovation capabilities, even in financially constrained enterprises. Fourth, this paper holds several policy implications as its findings introduce policymakers to new productive forces brought by corporate innovation. This paper offers ways to tackle the dual high phenomenon, a challenging issue for today's firms, and explores its relationship with innovation, and thus its findings may help regulatory bodies strengthen oversight of such firms, mitigate the

negative impacts of dual high on innovation capability, and support sustainable operations of Chinese textile enterprises.

The remainder of this paper is structured as follows: 2nd section covers empirical literature and theoretical framework to show the nexus between explanatory and explained variables, and develops hypotheses; 3rd section presents the empirical model, data and variables of study; 4th section reports empirical results, and 5th section presents the conclusion and policy implications.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Before 2017, dual high was seen as an indicator of inefficient capital use. Following the scandals of Kangde Xin and Kangmei Pharmaceutical, dual high has become a red flag for investors. The causes of dual high can be categorised into two types. The first type includes superficial factors, which generally do not result in actual economic consequences. Capital-intensive firms require sustained and ample cash flow to sustain daily activities and thus tend to hold large amounts of cash while borrowing externally [4, 5]. During China's economic transition period, evident "financial discrimination" made it easier for state-owned enterprises to receive government support and low-cost loans, leading to dual high [15]. The second type includes substantive factors, which generally result in actual economic consequences. Firms may have a large amount of non-liquid cash or other monetary funds that are not freely usable, leading to large interest-bearing debts [6]. Additionally, significant amounts of cash may be occupied by major shareholders or related parties, resulting in dual high [7].

Inefficient fund allocation results in increased financial risk and decreased financial flexibility, which significantly inhibits a firm's ability to invest in long-term strategic initiatives such as research and development (R&D). High debt level increases financial risk by imposing fixed obligations on the firm, which can strain cash flow and limit fund availability for innovation [16, 17]. When a substantial portion of a firm's resources is tied up in servicing debt, it reduces the capital available for investing in innovative projects, which are critical to maintain a strong competitive advantage [18]. Furthermore, decreased financial flexibility limits a firm's ability to adapt to changing market conditions and to be ready to invest in new technologies. High cash reserves coupled with high debt signal poor financial management and inefficient capital allocation, making it difficult for firms to respond to emerging market opportunities and threats [19]. This lack of flexibility can be detrimental in industries characterised by rapid technological change, where continuous innovation could be essential to survive [20]. Empirical evidences show that firms having constrained financial flexibility are less likely to engage in R&D activities, as they are not able to absorb the high costs and risks associated with innovation [21, 22]. Consequently, the dual high phenomenon creates a vicious cycle of financial distress and underinvestment in innovation initiatives, ultimately hindering a firm's long-term growth and competitiveness [23, 24].

Innovation is the primary driver of development, and the continuous operation and growth of enterprises inevitably require innovation. Currently, numerous studies have delved into the innovation capabilities of firms: There exists an inverted U-shaped relationship between internal control and corporate innovation [11]. The Shanghai-Hong Kong Stock Connect policy enhances corporate innovation capability [25]. The proportion of state ownership inhibits corporate innovation [26]. Strengthening government enforcement of intellectual property protection enhances corporate innovation capability [27]. Excessive financialization in the manufacturing sector suppresses innovation capability [28]. Yang and Xiong [29] found that dual high (high cash holdings and high debt levels) suppresses patent applications related to corporate innovation expenditures, but did not discuss its relationship with innovation input and patent grants. Therefore, this paper will explore the relationship between dual high and corporate innovation expenditures and inputs, thereby enhancing the existing literature and further elucidating the factors influencing corporate innovation capability.

The agency theory posits that a conflict of interest may arise between managers and shareholders regarding this issue, as managers tend to prioritise short-term financial stability over long-term innovation to secure their positions [30, 31], while shareholders strive for long-term economic success of firms to maximise their wealth. It can be explained that firms with substantial cash holdings and short-term loans have sufficient cash flow to ensure daily operations. However, due to the high proportion of short-term loans and the long timeline and uncertain returns associated with innovation, firms are less likely to invest heavily in innovation resources. Similarly, although a high proportion of short-term loans can provide additional funding, it may increase financial pressure and risk-bearing capacity. Consequently, firms may focus more on debt repayment and reduce investment in innovation activities. Drawing on these views and findings of previous literature, this hypothesis can be proposed:

Hypothesis 1: High volume of monetary funds and short-term borrowings impede firms' innovation capabilities.

China is among the forefront countries, adopting digital technologies to gain productivity and economic goals. Digitalisation is a critical factor to moderate the influence of short-term borrowings and monetary funds on corporate innovation by enhancing operational efficiencies, improving financial management, and facilitating access to new technologies for Chinese listed enterprises. Previous studies show that digitalisation enables firms to optimise their financial resources and reduce the adverse effects of high short-term debt. For example, Bardhan and

Krishnan [32] explain that digital capabilities improve firm performance via streamlining operations and reducing transaction costs, which can free up resources to invest in innovation initiatives. Similarly, Rao and Pan [33] demonstrate that digitalisation helps firms in managing their financial risks, enabling them to allocate more resources to R&D activities, despite high levels of short-term debt and monetary funds in hand.

Moreover, digitalisation improves the liquidity management of firms with substantial monetary funds, thereby improving their innovation capabilities. Khin and Ho [34] showed that digitalisation facilitates better cash flow management and financial planning, thus firms are able to maintain adequate liquidity while investing in innovative projects. Vial [35] supported this finding and indicated that digital tools and platforms provide more accurate and timely financial reporting, providing firms with better insights into their financial positions and enabling more strategic investment decisions. By leveraging digital technologies, firms are able to mitigate constraints imposed by short-term borrowings and high cash holdings, thus fostering a more conducive environment for innovation.

From a theoretical perspective, the Resource-Based View (RBV) explains the moderating effects of digitalisation on the nexus of high short-term borrowings and monetary funds with innovation capabilities. The RBV posits that firms achieve competitive advantage via leveraging unique resources and capabilities [36], and digitalisation is a valuable resource that can enhance a firm's strategic capabilities, including its innovation capability. According to this theory, firms with advanced digital capabilities can better utilise their financial resources, manage risks, and respond to market changes, thereby reducing the negative impact of high short-term borrowings and monetary funds on corporate innovation [37, 38]. The moderating effect of digitalisation is evident as it enables firms to overcome financial constraints and allocate resources more efficiently towards R&D and other innovative projects.

Hypothesis 2: Digitalisation moderates the influence of high volumes of monetary funds and short-term borrowings on firms' innovation capabilities.

Financial risk is a significant factor directly linked to short-term borrowings and monetary funds, and it may mediate their impact on a firm's innovation capability. Empirical literature suggests that high levels of short-term debt increase financial risk via imposing substantial fixed costs and principal repayment obligations, which can hinder a firm's liquidity and financial stability, and thus influence the move toward innovation initiatives. For instance, Almeida and Campello [37] found that firms with high leverage are more susceptible to financial distress, which forces them to adopt the strategies of debt servicing instead of innovation. Similarly, Wade and Hulland [38] suggested that financial constraints negatively influence a firm's capacity, as the need to meet short-term borrowings limits fund availability for R&D investments.

Additionally, holding substantial monetary funds can also result in financial risk, especially when these funds are not being utilised efficiently. Excessive cash holdings might signal poor financial management and lead to inefficiencies, as highlighted by Jensen [30], who argued that managers of cash-rich firms might engage in value-destroying activities instead of investing in profitable projects. This misallocation of resources may exacerbate financial risk, reducing the firm's ability to invest in innovative initiatives. Brown and Petersen [8] demonstrated that firms with high cash reserves but poor investment strategies tend to underperform in terms of innovation output compared to their peers with better financial management strategies and practices.

The financial risk theory by Modigliani and Miller [9] presents a robust framework to understand the mediating role of financial risk in influencing the nexus of high short-term borrowings and monetary funds. According to their proposition, the capital structure of a firm directly influences its financial risk and cost of capital. Firms with a high volume of short-term borrowings (high leverage) face higher financial risk because of the fixed nature of debt obligations, which may limit their flexibility in investing in innovative projects. Conversely, excessive cash holding without productive use may also increase financial risk by leading to inefficient capital allocation and agency problems [30]. Additionally, constrained by the nature of dual high, firms need to ensure timely repayment of deposits and loans, leading to short-term operational and profit-seeking pressures. This can cause firms to focus more on short-term gains, neglecting the cultivation and development of long-term innovation capabilities. Therefore, to reduce financial risk, firms may adopt more cautious and conservative measures, being unwilling to bear the uncertainties and risks associated with innovation, and on these views, this study posits this hypothesis:

Hypothesis 3: Financial risk mediates the nexus of high volume of monetary funds and short-term borrowings with firms' innovation capabilities.

RESEARCH DESIGN

Data sources and sample selection

This study primarily selects small, medium, and large-sized companies of the textile industry as the research sample. The corporate data is sourced from the CSMAR database, spanning the period from 2011 to 2022. To improve data quality and ensure research accuracy, the data is processed using Stata 17.0 econometric software as follows: removing ST and *ST companies from the sample; excluding firms with missing values for key variables; applying a 1% winsorization on both ends for continuous variables to avoid biases in regression estimates due to extreme values.

Variables selection

Dependent variables

Referring to the study by Yao and Zhu [39], this paper measures corporate innovation on two levels: innovation input (RD) and innovation output (Patent1 and Patent_Award1). Innovation input is measured by the ratio of R&D expenditure to operating revenue, while innovation output is measured by the number of patents. Given the lag in patents, relying solely on the number of applications does not adequately reflect a firm's actual innovation output. Therefore, this study also includes the number of granted patents for further refinement.

Independent variables

Dual High (DH1): The dual high phenomenon (DH1) is exhibited by firms maintaining high levels of monetary funds and short-term borrowings relative to their total assets. For the current study, we employ two thresholds to capture dual high characteristics. The first definition considers a firm as dual high if the ratio of monetary funds to total assets, and the ratio of short-term borrowings to total assets, exceed 15%. This serves as the benchmark definition (DH1), and the dual high phenomenon is measured in this study for baseline analysis. This threshold of 15% ensures a broader representation of firms with dual high characteristics, offering insights into how moderate levels of monetary funds and borrowings could impact the corporate innovation [40, 41].

The second definition of dual-high phenomenon (DH2) is stricter and classifies a firm as dual high only if both the ratio of monetary funds to total assets and the ratio of short-term borrowings to total assets exceed 20% [42]. This definition is used as a proxy variable (DH2) to measure the dual-high phenomenon in robust analysis. This definition captures more pronounced cases of dual high characteristics, and the proportion of firms meeting these criteria could be relatively low, potentially leading to small sample size representation. Firms meeting the criteria for either DH1 or DH2 are assigned a value of 1; otherwise, the value is 0.

Control variables

Referring to prior literature [43, 44], this study also controls for variables such as net profit margin of total assets, company size, etc. The definitions of the main variables in this paper are detailed in table 1.

Model construction

Based on the results of the Hausman test, this paper employs a two-way fixed effect model (1) to test the impact of the dual high phenomenon on corporate innovation capability:

$$Innovation_{i,t} = \alpha_0 + \alpha_1 DH1_{i,t} + \alpha_2 control_{i,t} + \\ + \theta_i + \mu_t + \varepsilon_{i,t} \quad (1)$$

where $Innovation_{i,t}$ includes the dependent variables $RD_{i,t}$, $Patent1_{i,t}$, $Patent\_Award1_{i,t}$, $DH1_{i,t}$ is the core independent variable. The control variables include net profit margin of total assets (ROA), company size (Size), revenue growth rate (Growth), the shareholding ratio of the largest shareholder (TOP1), years since the company's establishment (FirmAge), board size (Board), and cash flow ratio (Cashflow). $\varepsilon_{i,t}$ is the random disturbance term, α is the parameter to be estimated, θ_i represents firm fixed effects, and μ_t represents time fixed effects.

Table 1

VARIABLES DEFINITIONS

Variable category	Variable name	Variable code	Calculation method
Dependent variables	Innovation input	RD	R&D investment / Operating revenue
	Innovation output	Patent1	The natural logarithm of the total number of patent applications plus 1
		Patent_Award1	The natural logarithm of the total number of patents granted plus 1
Independent variables	Dual High effect	DH1	Proportion of short-term borrowings and monetary funds to total assets both exceeds 15%
		DH2	Proportion of short-term borrowings and monetary funds to total assets both exceeds 20%
Control variables	Return on total assets	ROA	Net profit / Average total assets
	Firm size	Size	Natural logarithm of total assets
	Operating revenue growth rate	Growth	Current year operating revenue/Last year operating revenue – 1
	Shareholding ratio of the largest shareholder	TOP1	Number of shares held by the largest shareholder / Total shares
	Firm age	FirmAge	ln(Current Year – Year of Establishment + 1)
	Board size	Board	Natural logarithm of the number of directors
	Cash flow ratio	Cashflow	Net cash flow from operating activities / Total assets

Table 2

DESCRIPTIVE STATISTICS					
Variable	**Obs**	**Mean**	**Std. dev.**	**Min**	**Max**
RD	21,552	4.671	6.582	0	424.9
Patent1	21,552	3.095	1.620	0	9.406
Patent_Award1	21,552	2.786	1.554	0	8.965
DH1	21,552	0.0852	0.279	0	1
ROA	21,552	0.0376	0.0762	–1.859	0.880
Size	21,552	22.25	1.301	17.81	28.64
Growth	21,552	0.392	13.57	–0.952	1878
TOP1	21,552	33.46	14.58	2.197	89.99
FirmAge	21,552	2.872	0.347	1.099	4.159
Board	21,552	2.122	0.196	1.099	2.890
Cashflow	21,552	0.0452	0.0685	–0.704	0.664

EMPIRICAL RESULTS

Descriptive statistics

The descriptive statistics results of this paper are shown in table 2. It is shown that the mean value of corporate innovation input (RD) is 4.671, with a minimum value of 0 and a maximum value of 424.9. The mean values of innovation output (Patent1 and Patent_Award1) are 3.095 and 2.786, respectively, with minimum values of 0 and maximum values of 9.406 and 8.965. This indicates a significant disparity in innovation capability among firms. The mean value of dual high (DH1) is 0.0852, indicating that 8.52% of the sample firms exhibit dual high characteristics. The distribution of control variables is generally consistent with the previous literature.

Multicollinearity test

To identify whether there is a multicollinearity problem among the variables in the model, we analyse the variance inflation factors (VIF) of the variables. As shown in column 1 of table 3, the maximum VIF for the model variables is 1.480, and the average VIF is 1.150. Generally, it is considered that when the VIF value does not exceed 5, the model does not have a serious multicollinearity problem. Therefore, there is no severe multicollinearity issue among the variables in this study, and it will not affect the accuracy of the model estimates.

Table 3

MULTICOLLINEARITY TEST RESULTS		
Variable	**(1)**	**(2)**
	VIF	**1/VIF**
Size	1.480	0.674
Patent_Award1	1.260	0.797
ROA	1.180	0.845
Cashflow	1.170	0.853
FirmAge	1.100	0.909
TOP1	1.090	0.916
RDSpendSumRatio	1.080	0.927
Board	1.070	0.933
DH1	1.010	0.989
Growth	1	0.996
Mean VIF	1.150	-

Baseline results

To explore the impact of dual high (DH1) on corporate innovation in depth, we conduct a regression analysis. The regression results are shown in table 4. The coefficient of dual high (DH1) on innovation input

Table 4

BASELINE REGRESSION RESULTS			
Variable	**(1)**	**(2)**	**(3)**
	RD	**Patent1**	**Patent_Award1**
DH1	–0.900***	–0.100***	–0.156***
	(0.104)	(0.029)	(0.028)
ROA	–4.183***	0.915***	0.209*
	(1.238)	(0.130)	(0.117)
Size	–0.439***	0.661***	0.622***
	(0.029)	(0.008)	(0.008)
Growth	0.021	–0.002***	–0.001***
	(0.027)	(0.000)	(0.000)
TOP1	–0.019***	–0.001*	–0.001
	(0.003)	(0.001)	(0.001)
FirmAge	–1.771***	–0.114***	–0.126***
	(0.267)	(0.028)	(0.027)
Board	–0.065	0.160***	0.098**
	(0.185)	(0.046)	(0.043)
Cashflow	–0.603	0.352**	0.522***
	(1.032)	(0.147)	(0.135)
_cons	20.538***	–11.624***	–10.909***
	(1.115)	(0.192)	(0.183)
Firm FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
N	21,552	21,552	21,552
r2	0.199	0.449	0.458
F	64.793	954.146	903.450

Note: ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively; standard errors are reported in parentheses.

(RD) is –0.900, and it is significant at the 1% level, indicating a significant negative correlation between dual high and innovation input. The coefficients of dual high (DH1) on innovation output (Patent1 and Patent_Award1) are –0.100 and –0.156, respectively, and both are significant at the 1% level, indicating a significant negative correlation between dual high and innovation output. In summary, dual high is significantly negatively correlated with corporate innovation capability, thus validating the hypothesis. The significantly negative correlation of dual high with both innovation input and innovation output suggests that when companies face dual high, they tend to reduce their investment in innovation, and their innovation output is also negatively affected. This may be because high-interest rates increase the financing costs for companies, thereby reducing the funds available for R&D and innovation. Additionally, high-interest rates might mean that companies, facing higher financial pressure, become more cautious and may choose to reduce risk investments, including innovation projects. Overall, findings presented by baseline regression support hypothesis 1.

Testing the robustness of baseline results

Changing the model

To eliminate the differences in results due to different regression models, this study retests the main hypothesis using a Tobit model.

As shown in table 5, dual high (DH1) is significantly negatively correlated with both innovation input and innovation output at the 1% level, and the conclusion remains unchanged.

Table 5

RESULTS WITH THE ALTERNATIVE MODEL			
Variable	**(1)**	**(2)**	**(3)**
	RD	**Patent1**	**Patent_Award1**
DH1	–1.236***	–0.152***	–0.203***
	(0.156)	(0.035)	(0.034)
_cons	30.737***	–8.043***	–7.588***
	(0.899)	(0.202)	(0.195)
var(e.Patent1)		2.040***	
		(0.020)	
var(e.RD)	40.341***		
	(0.389)		
var(e.Patent_Award1)			1.899***
			(0.018)
N	21,552	21,552	21,552
Control Var.	Yes	Yes	Yes

Note: ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively; standard errors are reported in parentheses.

Changing the explanatory variable

This study redefines "dual high" as the ratio of short-term loans and monetary funds to total assets exceeding 20% for two consecutive years and being higher than the industry average [45]. Under this definition, it is labelled DH2; if the condition is met, DH2 is 1, otherwise, it is 0. After regression, the results are shown in table 6. The redefined dual high (DH2) is significantly negatively correlated with both innovation input and innovation output at the 1% level, and the conclusion remains unchanged.

Table 6

RESULTS WITH PROXY OF EXPLANATORY VARIABLE			
Variable	**(1)**	**(2)**	**(3)**
	RD	**Patent1**	**Patent_Award1**
DH2	–0.885***	–0.274***	–0.315***
	(0.141)	(0.055)	(0.053)
_cons	20.567***	–11.628***	–10.911***
	(1.117)	(0.192)	(0.183)
Firm FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Control var.	Yes	Yes	Yes
N	21,552	21,552	21,552
r2	0.198	0.450	0.458
F	61.033	956.643	905.492

Note: ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively; standard errors are reported in parentheses.

Further analysis

Moderating effect of digitalisation

Digitalisation can, to some extent, suppress the dual high phenomenon in enterprises [46], and digital transformation can promote the improvement of corporate innovation performance [47]. Therefore, we believe that corporate digitalisation acts as a moderating variable between dual high and innovation capability. To this end, we introduce the interaction term between the moderating variable of corporate digitalisation and dual high (DH1), labelled DH_DCG. Before interaction, the explanatory and moderating variables are centred. The constructed model is as follows:

$$\text{Innovation}_{i,t} = \alpha_0 + \alpha_1 \text{DH1}_{i,t} + \alpha_2 \text{DH\_DCG}_{i,t} + \\ + \alpha_3 \textit{control}_{i,t} + \theta_i + \mu_t + \varepsilon_{i,t} \quad (2)$$

where $\text{Innovation}_{i,t}$ includes the explained variables $\text{RD}_{i,t}$, $\text{Patent1}_{i,t}$, $\text{Patent\_Award1}_{i,t}$. The regression results are shown in table 7. The results indicate that the interaction term DH_DCG exhibits a significant negative correlation with enterprise innovation at the 1% level, suggesting that the interactive effect between the level of enterprise digitalisation and the explanatory variable (DH1) significantly influences enterprise innovation, thereby we accept hypothesis 2.

Mediating effect of financial risk

If a company's financial risk is relatively high, it may exacerbate the impact of high deposits and high loans (DH) on its innovation capability. Firstly, financial risk may lead to investment constraints for the company, especially in the field of innovation. High debt ratios and high-interest expenses can limit a

Table 7

MODERATING EFFECTS OF DIGITALIZATION			
Variable	**(1)**	**(2)**	**(3)**
	RD	**Patent1**	**Patent_Award1**
DH1	–0.913***	–0.102***	–0.156***
	(0.105)	(0.029)	(0.028)
DH_DCG	–0.310***	–0.079***	–0.056***
	(0.076)	(0.021)	(0.021)
DCG	0.286***	0.113***	0.105***
	(0.043)	(0.008)	(0.007)
_cons	20.866***	–11.494***	–10.788***
	(1.098)	(0.191)	(0.182)
Firm FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Control Var.	Yes	Yes	Yes
N	21,552	21,552	21,552
r2	0.201	0.455	0.463
F	60.712	796.759	756.987

Note: ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively; standard errors are reported in parentheses.

company's cash flow, making it difficult to obtain sufficient funds for innovation activities. These investment constraints may hinder the company's R&D and other innovation activities, thereby reducing its innovation capability. Secondly, as mentioned earlier, signalling theory suggests that financial risk can send negative signals to the company's shareholders and investors, reducing their confidence and support for the company. Investors may worry that the company cannot bear the high debt burden, thereby decreasing their willingness to invest in the company. This could limit the company's financing capacity, further weakening its innovation capability. Finally, financial risk may cause the company to focus more on risk aversion rather than pursuing innovation. The company might become more cautious in innovation projects, avoiding taking on excessive risks, which could cause the company to miss out on potential innovation opportunities. Based on this, we use the "Oscore" proposed by Ohlson [48] to reflect the company's financial risk and construct the following model:

$$OScore_{i,t} = \alpha_0 + \alpha_1 DH1_{i,t} + \alpha_2 control_{i,t} + \theta_i + \mu_t + \varepsilon_{i,t} \quad (3)$$

$$Innovation_{i,t} = \alpha_0 + \alpha_1 OScore_{i,t} + \alpha_2 DH1_{i,t} + \alpha_3 control_{i,t} + \theta_i + \mu_t + \varepsilon_{i,t} \quad (4)$$

where $Innovation_{i,t}$ includes the dependent variables $RD_{i,t}$, $Patent1_{i,t}$, $Patent\_Award1_{i,t}$. The results are shown in table 8. After adding the mediation variable, the relationship between DH and corporate innovation remains significantly negatively correlated at the 1% level, and the absolute value is smaller than the regression results without the mediation variable, indicating that the mediation effect is established, and this finding led us to accept hypothesis 3.

Heterogeneity analysis: Firm level

Due to possible differences in financing structures between state-owned enterprises (SOEs) and non-state-owned enterprises (non-SOEs), SOEs may rely more on traditional financing methods such as bank loans, while non-SOEs may prefer diversified financing channels, including equity financing, bond financing, etc. Therefore, DH may have different impacts on the financing costs and available funds for the two types of enterprises, thereby affecting their innovation input and output. The inhibitory effect of DH on the innovation capability of non-SOEs is stronger compared to SOEs. Based on this, we divided the sample into SOEs and non-SOEs for regression analysis, as shown in table 9. The regression results show that DH has a significantly negative correlation with the innovation capability of non-SOEs at the

Table 8

MODERATING EFFECTS OF FINANCIAL RISK				
Variable	**(1)**	**(2)**	**(3)**	**(4)**
	OScore	**RD**	**Patent1**	**Patent_Award1**
DH1	0.879***	–0.453***	–0.081***	–0.140***
	(0.030)	(0.099)	(0.031)	(0.030)
OScore		–0.396***	0.008	0.010*
		(0.029)	(0.006)	(0.005)
_cons	–13.379***	13.863***	–11.524***	–10.746***
	(0.254)	(0.840)	(0.218)	(0.209)
Firm FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Control Var.	Yes	Yes	Yes	Yes
N	19761	19761	19761	19761
r2	0.548	0.274	0.452	0.460
F	651.483	69.686	781.872	737.934

Note: ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively; standard errors are reported in parentheses.

Table 9

MODERATING EFFECTS OF FINANCIAL RISKFIRM OWNERSHIP HETEROGENEITY ANALYSIS RESULTS

Variables	SOEs			Non-SOEs		
	(1)	(2)	(3)	(4)	(5)	(6)
	RD	Patent1	Patent_Award1	RD	Patent1	Patent_Award1
DH1	–0.522***	–0.061	–0.114**	–1.036***	–0.101***	–0.160***
	(0.142)	(0.052)	(0.051)	(0.179)	(0.036)	(0.034)
_cons	13.735***	–11.780***	–11.481***	22.993***	–10.496***	–9.785***
	(0.960)	(0.370)	(0.354)	(1.782)	(0.276)	(0.262)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Control Var.	Yes	Yes	Yes	Yes	Yes	Yes
N	6576	6576	6576	14615	14615	14615
r2	0.325	0.546	0.550	0.204	0.390	0.402
F	22.153	400.218	388.997	27.883	385.449	366.020

Note: ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively; standard errors are reported in parentheses.

1% level, indicating heterogeneity in the impact of DH on the innovation capability of SOEs and non-SOEs.

CONCLUSIONS AND POLICY IMPLICATIONS

Using data of 1,796 textile companies of China spanning over 2011–2022, this paper examines the nexus between the dual high (DH) phenomenon and corporate innovation capabilities. Using a two-way fixed effects model, this study confirms that the DH phenomenon significantly hinders corporate innovation capabilities of Chinese textile enterprises, mainly through its impact on corporate financial risk and resource allocation. The mediation effect of financial risk necessitates effective financial risk management strategies, as high financial risk arising from the DH phenomenon could divert resources away from long-term strategic investments like innovation. Textile enterprises with pronounced DH characteristics could face higher financial risks, compelling them to adopt conservative financial strategies that may reduce their R&D investments, ultimately inhibiting the corporate innovation potential. Digitalisation is found to be a significant factor in reducing the DH phenomenon on the innovation capabilities of Chinese textile enterprises. Additionally, this paper identified significant differences in the impact of the DH phenomenon on innovation capabilities across ownership structures. Non-state-owned enterprises (non-SOEs) experience stronger inhibitory effects of DH on innovation capabilities compared to the state-owned enterprises (SOEs). This disparity indicates that non-SOEs would lack the institutional support and financial flexibility that could allow them to amplify the adverse effects of DH.

There are several policy implications presented by this paper: Specifically, findings presented for hypothesis 1 highlight the negative impact of the dual high phenomenon on corporate innovation capabilities, and push the Chinese regional government to support textile companies by offering tax incentives, subsidies, and policies that can encourage diversified financing channels, such as equity financing or bond issuance. These measures may help these enterprises to reduce their reliance on bank loans and thus mitigate financial constraints linked with the dual high phenomenon, thereby fostering corporate innovation capabilities of textile enterprises. Findings indicated by hypothesis 2 encourage textile companies of China to promote digital transformation so they can have efficient resource allocation and improved innovative performance. Findings based on hypothesis 2 push Chinese textile enterprises to adopt effective financial risk management strategies so they can mitigate the adverse effects of dual high characteristics on corporate innovation. Additionally, Diversified financing channels can provide textile companies with more options, lessening the suppressive effect of DH on innovation capability. Regulatory authorities should require textile companies to enhance information disclosure and transparency, including key information about their financial status, borrowing activities, and asset-liability structure. This transparency facilitates the assessment and monitoring of a company's risk status by regulatory authorities and investors. By improving information disclosure and transparency, regulatory authorities can better understand a company's risk status and take necessary regulatory measures promptly.

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