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Capitalisation of research and development investment and enterprise value: a study on the threshold effect based on level of financialisation

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ABSTRACT

This study uses a mathematical model to explore how enterprises' financialisation levels affect the role of research and development (R&D) investment capitalisation in enterprise value. We construct a mathematical model involving the financialisation level, capitalised R&D investment, and enterprise value. The sample comprises A-share listed companies that disclosed the capitalisation of R&D investment in the Shanghai and Shenzhen stock markets from 2014 to 2020. The results suggest that R&D investment capitalisation positively impacts enterprise value, especially in the current phase. With financialisation level as the threshold variable, R&D investment capitalisation has a double threshold effect on enterprise value in the current and next phases. Additionally, corporate financial investment behaviour has a timely impact on capitalised R&D investment but does not significantly impact enterprise value in a future phase. Enterprises evidently choose financial investment to enhance enterprise value by increasing capitalised R&D investment. These results can help enterprises formulate financial asset investment strategies and promote their development from virtual to real. The government should standardise enterprises' financial investment behaviour, prevent excessive financialisation, and promote high-quality development of the real economy.

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1. Introduction

International Accounting Standard 38 Intangible Assets requires a firm to recognise the expenditure in the research stage as an expense when it occurs and declare the expenditure in the development period as an intangible asset after meeting the recognition conditions. The new accounting standards implemented in China in 2007 stipulate the accrual of research and development (R&D) investments. Firms' R&D investments are divided into two parts: expense and capitalisation, based on the

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formation of intangible assets. There are strict recognition conditions for capitalised R&D investments; compared with R&D investments, capitalised R&D investments have higher value relevance for firms. At the same time, in today's dynamic innovation system, scientific and technological developments are particularly important. R&D innovations are, undoubtedly, key drivers of firms' high-quality development, and capitalised R&D investments are particularly important in conducting innovation activities. Therefore, exploring the relationship between R&D investment capitalisation and firm value is of significance.

Existing research on the capitalisation of R&D expenditure mainly comes from foreign countries that allow its capitalisation, with varying conclusions. Godfrey and Koh (2001) stated that there is no correlation between firm value and the capitalisation of R&D expenditure. Chan et al. (2007) used data on Australian listed enterprises during 1991–2002 and controlled the variable of enterprise R&D intensity to find that the market performance of R&D investment capitalisation was better than that of R&D investment. However, after the implementation of international accounting standards in the United Kingdom (UK), Tsoligkas and Tsalavoutas (2011) studied the correlation between enterprise R&D investment capitalisation and expenditure and enterprise value. They found that the capitalisation of R&D expenditure was positively correlated with enterprise value, showing that successful R&D can bring future economic profits for the enterprise. Moreover, the expense of R&D expenditure was negatively correlated with enterprise value and hence could not generate economic profits. Han and Manry (2004), Ahmed and Falk (2006), and Shah et al. (2013) reached similar conclusions. Gu (2016) used a standard real options model to predict that R&D-intensive enterprises face greater risks along with higher stock returns. However, owing to their long-term and uncertain nature, enterprise innovation activities are seriously constrained by fund availability and mainly rely on internal financing. The financialisation of industrial capital widens the financing channels of enterprises (Bonfiglioli, 2008). As an endogenous variable of technological innovation, it improves the technological innovation ability of the manufacturing industry (Arizala et al., 2013) and promotes enterprise value. However, only when the financial market is sufficiently developed will enterprises be prompted to transfer surplus assets into innovation investments. Furthermore, excessive financialisation may also shift enterprises' focus from production to financial investment, resulting in a lack of sufficient funds for upgrading equipment for R&D innovation, thereby changing the enterprise profit model (Tori & Onaran, 2017) and inhibiting the real economy's development (Wu, 2021). The impact of enterprise financialisation on R&D innovation is not a simple linear relationship, and an interval effect may exist. This leads to the research question of whether the financialisation level affects the relationship between capitalised R&D investment and enterprise value, showing an interval effect.

This study examines the impact of R&D investment capitalisation on enterprise value from the perspective of the financialisation level. Its' possible research contributions are reflected in the following three aspects. First, the previous literature on the relationship between R&D investment capitalisation and enterprise value mostly focuses on policy applicability and the efficiency of R&D investment capitalisation in measuring enterprise value. From a financial perspective, few studies examine the relationship between R&D investment capitalisation and enterprise value. Therefore, based on the level of enterprise financialisation, this study discusses the impact of R&D investment capitalisation on enterprise value. Second, based on the production function, this study constructs a theoretical model involving the financialisation level, capitalised R&D investment, and enterprise value. It analyses the nonlinear relationship between capitalised R&D investment and enterprise value and uses the threshold response model considering the financialisation level as the threshold variable. Third, using the intermediary effect, this study compares the two action paths of 'financial level–enterprise profit–enterprise value' and 'financial level–capitalised R&D investment–enterprise value' and further analyses the specific action mechanism of enterprise financial level on enterprise value. The results show that enterprises choose financial investment not to whitewash short-term enterprise profits and promote enterprise value but to enhance enterprise value by increasing capitalised R&D investment.

2. Theoretical analysis and research hypotheses

2.1. Capitalisation of R&D investment and enterprise value

In China, with the implementation of new accounting standards and the gradual standardisation of supervision, the usefulness of information on the capitalisation of R&D investment is increasing year by year, and the estimation function of accounting information has improved (Huang et al., 2022). This can signal enterprise R&D 'success' to the market, which is conducive to external investors obtaining information on enterprise R&D progress in time, eliminates the information gap with the enterprise's internal managers, and enhances its ability to predict enterprise value. In addition, the capitalisation of R&D investment can promote technological innovation and boost enterprise value by improving the level of R&D investment. Furthermore, the new accounting standards stipulate that an enterprise's R&D investment can be capitalised only when it meets at least the following three conditions: (1) it is technically feasible to use or sell the intangible asset after its successful development; (2) the intangible asset or new product will be used or sold when it is completed; (3) technical, financial, and other resources are sufficient to support the successful development of the intangible asset or new product, and the firm then has the ability to use or sell the intangible asset or new product. These three conditions also mean that capitalised R&D investments can serve as assets and bring future economic benefits for the enterprise. Therefore, this study considers the capitalisation of R&D investment to promote enterprise value by forming intangible assets or products.

This study attempts to build a theoretical model to further analyse and explain the impact of R&D investment capitalisation on enterprise value. Based on the extant literature on R&D investment and productivity, the traditional Cobb–Douglas production function is used to add R&D investment factors to expand the new production function:

$$Y_t = Ae^{x_t}K_t^{\alpha}C_t^{\beta}L_t^{\gamma}, \tag{1}$$

where Y_t is the output of the enterprise in period t; $K_t, C_t,$ and L_t are the R&D investment, physical capital investment, and human capital investment, respectively, of the enterprise in period t; and α, β, and γ are the output elasticities of R&D investment, physical capital investment, and human capital investment, respectively. A is a constant, and x_t is an unknown impact. Considering that there may be collinearity among R&D investment, physical capital investment, and human capital investment, we rewrite Equation (1) in the ratio form as:

$$y_t = Ae^{x_t}k_t^{\alpha}c_t^{\beta}l_t^{\gamma}, \tag{2}$$

where y_t is the productivity of the enterprise in period t; and k_t, c_t, and l_t are the R&D investment ratio, physical capital investment ratio, and human capital investment ratio, respectively, of the enterprise in period t. As this study mainly focuses on R&D investment, assuming that the enterprise's physical capital investment ratio and the human capital investment ratio do not change, Equation (2) can be simplified to

$$y_t = Be^{x_t}k_t^{\alpha}, \tag{3}$$

where $B = Ac_t^{\beta}l_t^{\gamma}$. In this study, the stock of R&D investment is calculated using the perpetual inventory method to obtain

$$k_t = (1-\delta)k_{t-1} + r_t, \tag{4}$$

where k_t is the R&D investment stock in phase t, δ is the depreciation rate of R&D input stock, and r_t is the R&D investment in period t. According to the new accounting standards, R&D investment is divided into capitalised and expensed parts, and r_t can be expressed as:

$$r_t = n_t + m_t, \tag{5}$$

where n_t and m_t are the capitalised and expensed parts of R&D investment in phase t, respectively. The capitalised part of R&D investment refers to the successful innovation by the firm in production technology and new products with innovative components, whereas the expensed part is included in R&D expenses as cost deduction. Adopting the secondary adjustment cost function, the firm investment adjustment cost function can be obtained as follows:

$$\mathrm{g}(n_t, k_t) = \frac{a}{2}\cdot\frac{n_t^2}{k_t}, \tag{6}$$

where $a > 0$. The firm investment adjustment cost means that the change in firm investment in the current period will cause a change in cost. In this study, it may be due to the reorganisation of production lines and manual training caused by new technology and products.

This study estimates the firm value based on the dividend cash flow model. The firm's dividend is the retained earnings after income plus intangible assets minus investment and cost; then,

$$d_t = y_t + n_t - r_t - \frac{a}{2} \cdot \frac{n_t^2}{k_t} \tag{7}$$

Equation (5) can then be simplified to

$$d_t = y_t - m_t - \frac{a}{2} \cdot \frac{n_t^2}{k_t} \tag{8}$$

Suppose the random discount factor is $M_{t,\,t+j}$, the firm value is the cumulative sum of the present value of dividends in each period. The firm maximises the present value of dividends in each period by adopting an optimal production and investment strategy. Therefore, the objective function of firm value can be obtained as follows:

$$\mathrm{V}(n_t, m_t, k_t) = \max_{n_{t+j},\, m_{t+j},\, k_{t+j}} E_t \sum_{j=0}^{\infty} M_{t,\,t+j} d_{t+j} \tag{9}$$

The constraints are (4) and (6), and when the Lagrange algorithm is used to solve the first-order partial derivative of $n_t, m_t, k_t,$ the optimal solution is:

$$\lambda_t = a \cdot \frac{n_t}{k_t} \tag{10}$$

$$\lambda_t = 1, \tag{11}$$

and

$$\lambda_t = \alpha B e^{x_t} k_t^{\alpha-1} + \frac{a}{2} \cdot \frac{n_t^2}{k_t^2} + E_t M_{t,\,t+1}(1-\delta)\lambda_{t+1}, \tag{12}$$

where λ_t is the Lagrange multiplier of Constraint (4). Equation (10) indicates that when the marginal cost of capitalised R&D investment in the current period equals marginal revenue, the value of the firm is maximised. Equation (11) indicates that when the marginal cost of R&D investment equals marginal revenue, the value of the firm is maximised and the marginal cost of the investment is 1. Equation (12) represents the present value of the future marginal revenue that will be generated by the current enterprise R&D investment.

Combined with the Lagrange multiplier, the reorganised firm value is:

$$\mathrm{V}(k_t) = (1-\alpha)Be^{x_t}k_t^{\alpha} + \lambda_t(1-\delta)k_{t-1} + E_t \sum_{j=1}^{\infty} M_{t,\,t+j}(1-\alpha)Be^{x_{t+j}}k_{t+j}^{\alpha} \tag{13}$$

In Equation (13), $(1-\alpha)Be^{x_t} > 0,$ which means that, theoretically, business value can be affected positively by R&D investment k_t. As $k_t = (1-\delta)k_{t-1} + n_t + m_t$, R&D investment k_t can also be affected positively by capitalised R&D investment n_t. According to the conduction effect, capitalised R&D investment can positively affect enterprise value. Therefore, this study proposes the following hypothesis:

H1: The capitalisation of enterprise R&D investment has a facilitation effect on the improvement of enterprise value in the current period.

The complexity of R&D investment makes it difficult to predict its value in the current period. R&D investment and the current stock price changes are not related; rather, they experience a lag (Vithessonthi & Racela, 2016). Lev and Sougiannis (1996) found that the level of capitalisation of R&D investment is not only related to the enterprises' present value but it also impacts their future value. Capitalised R&D expenditure forms intangible assets for the enterprise, which can also signal R&D 'success' to the market. The higher the degree of capitalisation of R&D expenditure, the more the contribution of R&D expenditure in the next phase (Kim et al., 2021). Vithessonthi and Racela (2016) also found that in the long run, R&D investment has a positive impact on the enterprise value.

On combining Equations (4) and (5), we obtain $k_t = (1-\delta)^t k_0 + (1-\delta)^{t-1} n_1 + (1-\delta)^{t-1} m_1 + \cdots + (1-\delta) n_{t-1} + (1-\delta) m_{t-1} + n_t + m_t$. We find that capitalised R&D investment affects R&D investment for many periods. In Equation (13), firm value is also affected by capitalised R&D investment in the previous periods. Meanwhile, we compare the coefficient of the capitalisation of R&D investment n_t, n_{t-1}, $n_{t-2} \ldots n_1$, because $0 < (1-\delta) < 1$, thus $1 > (1-\delta) > \ldots > (1-\delta)^{t-1} > (1-\delta)^t$. This implies that capitalised R&D investment impacts current firm value more than the future value, and the impact degree shows a decreasing trend. Therefore, this study proposes the following hypotheses:

H2: The capitalisation of firm R&D investment will improve firm value in the future.

H3: The intensity at which the capitalisation of R&D investment improves enterprise value decreases with time.

2.2. Financialisation level and enterprise value

Krippner (2005) proposed the now widely accepted definition of financialisation. Profits are more dependent on financial investment activities than on production and trade activities. At the micro level, the definition of enterprise financialisation is mostly based on the financialisation characteristics of non-financial enterprises, including the increasing investment of non-financial enterprises in financial assets and financial institutions (Tori & Onaran, 2017). Based on existing research, this study defines enterprise financialisation as non-financial enterprises' behaviour aimed at increasing their investment in financial assets.

Non-cash financial assets have strong liquidity, like cash assets, and can serve as an effective tool for liquidity management. While searching for potential investment opportunities or facing financial difficulties, enterprises can choose to quickly realise financial assets to supplement liquidity and alleviate capital pressure. Especially for enterprises with financing constraints, the characteristics of 'liquidity management tools' of financial assets are more salient (Almeida et al., 2004). Simultaneously, enterprises can obtain income by allocating financial assets, alleviating external financing constraints, increasing R&D investment, improving enterprise innovation ability, and enhancing enterprise value. However, Jin and Myers (2006) and Hutton et al. (2009)

state that, as financial investment is a convenient tool to adjust profits, when the enterprise management increases financial investment for speculation, it can whitewash short-term and market performances, temporarily concealing any bad news about enterprise prospects. When the accumulation of negative information exceeds the threshold, it is released. This eventually leads to the collapse of its stock prices. In addition, according to the cash flow competition effect, due to limited resources with enterprises, there is cash flow competition in selecting different investment projects, leading to a substitution effect between physical and financial investments. When the total amount of capital is certain, if enterprises invest too much capital in financial assets rather than R&D investment, it will reduce enterprises' innovation ability and inhibit the promotion of enterprise value. Therefore, this study considers an interval effect between the financialisation level and capitalised R&D investment. The impact of R&D investment capitalisation on enterprise value changes with the financialisation level.

This study adds the financial level variable to the previous theoretical model and discusses the impact of financial level on the relationship between capitalised R&D investment and enterprise value. Corresponding to the external financial investment, such as the purchase of bonds by enterprises, this study assumes that the internal investment mode of enterprises is cash holding, and there are only two investment behaviours: cash investment and financial investment in investment activities. Consistent with the findings of Huang and Wang (2009), the cash capital accumulation process of enterprises is similar to that of R&D investment, and the cash capital stock is obtained as:

$$h_t = (1 - \delta_h)h_{t-1} + o_t, \tag{14}$$

where δ_h is the inflation rate, o_t is the cash capital investment in period t, and h_t is the cash capital stock in period t, that is, the cash level held by the enterprise. The costs related to cash holding are transaction expenses, because holding cash can impede the conversion of non-cash assets in the process of production and operation into cash and generate transaction expenses. The transaction fee as given by Huang and Wang (2009) is:

$$\mathrm{T}\left(n_t^2, h_t + o_t\right) = \frac{f}{2} \cdot \frac{n_t^2}{h_t + o_t}, \tag{15}$$

where $f > 0$. This study only calculates the transaction cost of capitalised R&D investment because the transaction cost of expensed R&D investment has been calculated, and transaction costs such as the formation of financial assets are considered to be directly included in the financial investment cost. Then, the financial investment of enterprise b_t is income minus R&D investment, cash investment, adjustment cost, and transaction expenses, or

$$b_t = y_t - n_t - m_t - o_t - \frac{a}{2} \cdot \frac{n_t^2}{k_t} - \frac{f}{2} \cdot \frac{n_t^2}{h_t + o_t} \tag{16}$$

Referring to Huang and Wang (2009) definition of the enterprise's external financing cost function, the return function of financial investment is:

$$F_t = I_b \cdot \omega \cdot b_t, \tag{17}$$

where I_b is an indicative function; when $b_t > 0$, $I_b = 1$, and when $b_t < 0$, $I_b = 0$; ω is the financial level of the enterprise. Currently, the enterprise dividend is the retained earnings after income plus the formed intangible assets and financial investment income minus R&D investment, cash capital, adjustment cost, and transaction expenses, that is:

$$d_t = y_t + I_b \cdot \omega \cdot b_t - m_t - o_t - \frac{a}{2} \cdot \frac{n_t^2}{k_t} - \frac{f}{2} \cdot \frac{n_t^2}{h_t + o_t} \tag{18}$$

Establishing the objective function in combination with Equation (9):

$$\mathrm{V}(n_t, m_t, o_t, k_t, h_t) = \max_{n_{t+j}, m_{t+j}, o_{t+j}, k_{t+j}, h_{t+j}} E_t \sum_{j=0}^{\infty} M_{t,t+j} d_{t+j} \quad (19).$$

The constraints are (4, 6, 14), and (15). The Lagrange algorithm is used to calculate n_t, m_t, o_t, k_t, h_t to find the first-order partial derivative, and the optimal solutions are:

$$\lambda_t^k = (1 + I_b \cdot \omega)\left(a \cdot \frac{n_t}{k_t} + f \cdot \frac{n_t}{h_t + o_t}\right) + I_b \cdot \omega \tag{20}$$

$$\lambda_t^k = 1 + I_b \cdot \omega \tag{21}$$

$$\lambda_t^h = (1 + I_b \cdot \omega)\left[1 - \frac{f}{2} \cdot \frac{n_t^2}{(h_t + o_t)^2}\right] \tag{22}$$

$$\lambda_t^k = (1 + I_b \cdot \omega)\left(\alpha B e^{x_t} k_t^{\alpha - 1} + \frac{a}{2} \cdot \frac{n_t^2}{k_t^{\,2}}\right) + E_t M_{t,t+1}(1 - \delta)\lambda_{t+1}^k \tag{23}$$

and,

$$\lambda_t^h = (1 + I_b \cdot \omega) \cdot \frac{f}{2} \cdot \frac{n_t^2}{(h_t + o_t)^2} + E_t M_{t,t+1}(1 - \delta_h)\lambda_{t+1}^h, \tag{24}$$

where λ_t^k and λ_t^h are the Lagrange multipliers of Constraints (4) and (14), respectively. Equation (20) indicates that the enterprise value is maximised when the marginal cost of capitalised R&D investment in the current period equals the marginal income. Equation (21) indicates that when the marginal cost of R&D investment equals the marginal income, the enterprise value is maximised. Equation (22) shows that the enterprise realises optimisation when the marginal cost of cash investment equals the marginal income. Equation (23) represents the present value of the value added to the enterprise by each additional unit of R&D investment, that is, the present value of the future marginal income generated by the current R&D investment.

Combined with the Lagrange multiplier, and by reorganising to obtain enterprise value, we get,

$$V = (1 + I_b \cdot \omega) \cdot (1 - \alpha)Be^{x_t}k_t^{\alpha} + \lambda_t^k(1 - \delta)k_{t-1} + \lambda_t^h(1 - \delta_h)h_{t-1} + E_t\sum_{j=1}^{\infty} M_{t,t+j}(1 + I_b \cdot \omega) \cdot (1 - \alpha)Be^{x_{t+j}}k_{t+j}^{\alpha} \tag{25}$$

Combining Equations (4) (5), and the Lagrange multiplier, Equation (25) is used to calculate the capitalised R&D investment n_t to find the first-order partial derivative and organise it as follows:

$$\frac{\partial V}{\partial n_t} = (1 + I_b \cdot \omega) \cdot Be^{x_t}k_t^{\alpha} + I_b \cdot \omega - (1 + I_b \cdot \omega)\left(\frac{a}{k_t} + \frac{f}{h_t + o_t}\right)n_t \tag{26}$$

Let $\frac{\partial V}{\partial n_t} = 0$ to obtain

$$I_b \cdot \omega = \frac{a \cdot \frac{n_t}{k_t} + f \cdot \frac{n_t}{h_t + o_t} - Be^{x_t}k_t^{\alpha}}{1 + Be^{x_t}k_t^{\alpha} - a \cdot \frac{n_t}{k_t} - f \cdot \frac{n_t}{h_t + o_t}} \tag{27}$$

From Equation (27), when $I_b \cdot \omega > \frac{a \cdot \frac{n_t}{k_t} + f \cdot \frac{n_t}{h_t + o_t} - Be^{x_t}k_t^{\alpha}}{1 + Be^{x_t}k_t^{\alpha} - a \cdot \frac{n_t}{k_t} - f \cdot \frac{n_t}{h_t + o_t}}$, capitalised R&D investment has a positive impact on enterprise value; when $I_b \cdot \omega < \frac{a \cdot \frac{n_t}{k_t} + f \cdot \frac{n_t}{h_t + o_t} - Be^{x_t}k_t^{\alpha}}{1 + Be^{x_t}k_t^{\alpha} - a \cdot \frac{n_t}{k_t} - f \cdot \frac{n_t}{h_t + o_t}}$, capitalised R&D investment has a negative impact on enterprise value. Therefore, this study holds that the financialisation level, ω, affects the effect of capitalised R&D investment on enterprise value. Therefore, the following hypotheses are postulated:.

H4: When the financialisation level is taken as the threshold variable, there is a threshold effect on the impact of capitalisation of enterprise R&D investment on the current enterprise value.

H5: When the financialisation level is taken as the threshold variable, there is a threshold effect on the impact of enterprise R&D investment capitalisation on future enterprise value.

3. Research design

3.1. Data sources

Taking the A-share listed companies in the Shanghai and Shenzhen stock markets that disclosed capitalisation of R&D investment from 2014 to 2020 as the research sample and excluding financial and special treatment listed companies, we obtained the panel data of 1,686 listed companies. The data related to the R&D investment of listed companies involved in this study were manually collected by consulting the annual reports of listed companies disclosed by the information, and other financial

Table 1. Variable definitions.

Variable name	Variable name	Variable definition
Firm value	*TobinQ1*	(Price per share* number of tradable shares + net assets per share* number of non-tradable shares + book value of liabilities)/total assets at the end of the period
	TobinQ2	(Price per share* number of tradable shares + price per share* number of non-tradable shares + book value of liabilities)/total assets at the end of the period
Capitalisation of R&D investment	*Ratio*	Capitalised R&D investment/total R&D investment
R&D investment intensity	*RDTA*	R&D investment/total assets
Financial level	*Fin*	Non-monetary financial assets/total assets
Firm size	*Size*	Natural logarithm of total assets of the firm
Asset liability ratio	*Lev*	Total liabilities/total assets
Profitability	*Roe*	Return on net assets
Development capacity	*Dev*	Net profit growth rate
Firm age	*Age*	Years from the year of listing to the current period
Ownership concentration	*Own*	Shareholding ratio of the largest shareholder
Shareholding ratio of management	*Man*	Number of shares held by management / total share capital
Chairman and CEO	*Dual*	The value of chairman concurrently serving as CEO in this year is 1, otherwise it is 0
Annual effect	*Year*	Annual dummy variable
Industry effect	*Industry*	Industry dummy variable

Note: R&D = Research and Development; CEO = Chief Executive Officer.
Source: the annual reports of listed companies and the China Stock Market & Accounting Research(CSMAR) database.

data were derived from the China Stock Market & Accounting Research (CSMAR) database.

3.2. Selection and measurement of variables

3.2.1. Dependent variable: firm value (TobinQ)

For the measurement of firm value, *the TobinQ* index is usually used in the literature. This index effectively reflects a company's value creation ability by calculating the ratio of firm's marketable value to the capital cost of reproduction. To test the stability of the demonstration, this study used two methods to calculate the *TobinQ* value of the company as depicted in Table 1.

3.2.2. Explanatory variable

3.2.2.1. Capitalisation of R&D investment (ratio). According to the existing literature, this study used the proportion of capitalised R&D investment in the total R&D investment, that is, the capitalisation rate of R&D investment, to express the capitalisation level of firm R&D investment.

3.2.2.2. R&D investment intensity (RDTA). Referring to the existing literature, this study used the R&D investment of a company divided by year-end total assets as the intensity of a firm's R&D investment (Huang et al., 2021). In the robustness test, the intensity of a firm's R&D investment was measured by the proportion of the firm's R&D investment in its operating revenue each year (Guo et al., 2021, p. 3) *threshold variable: financial level (fin)*

Based on the literature, this study used the proportion of non-monetary financial assets to total assets for measuring the financialisation level of threshold variables.

Non-monetary financial assets include held-to-maturity investments, trading financial assets, available for sale financial assets, investment real estates, dividends receivable, and interest receivable (Demir, 2009, p. 4) *control variable set (CV)*

This study controlled for the firm's characteristic and governance variables. We selected the following firm's characteristic variables: firm size (*Size*), asset liability ratio (*Lev*), profitability (*Roe*), capacity development (*Dev*), and firm's age (*Age*). We then selected the following corporate governance variables: ownership concentration (*Own*), management shareholding ratio (*Man*), and the case of the chairman also serving as CEO (*Dual*). The study also controlled for the fixed effects of year and industry (see Table 1 for the definitions of these variables).

3.3. Construction of empirical model

This study found that the capitalisation of R&D investment impacts firm value. It further tested whether the impact of R&D investment capitalisation on enterprise value has threshold characteristics when the level of enterprise financialisation is taken as the threshold variable.

First, we used Models (28, 29), and (30) to examine the impact of R&D investment capitalisation on enterprise value in the current period and the future. In the model, the intensity of R&D investment variable (*RDTA*) and R&D investment capitalisation variable (*Ratio*) were added at the same time, considering that the impact of R&D investment capitalisation on enterprise value depends on the intensity of firm R&D investment. As some unobservable company characteristics are time invariant during the sample period, this study used a panel regression model.

$$TobinQ_{it} = \kappa_1 Ratio_{it} + \nu_1 RDTA_{it} + \lambda_1 CV_{it} + Year + Industry + \varepsilon_{it} \tag{28}$$

$$TobinQ_{it+1} = \kappa_2 Ratio_{it} + \nu_2 RDTA_{it} + \pi_2 TobinQ_{it} + \lambda_2 CV_{it} + Year + Industry + \varepsilon_{it} \tag{29}$$

$$TobinQ_{it+2} = \kappa_3 Ratio_{it} + \nu_3 RDTA_{it} + \pi_3 TobinQ_{it} + \lambda_3 CV_{it} + Year + Industry + \varepsilon_{it}, \tag{30}$$

where i denotes the company; t denotes time; κ_i, ν_i are the coefficients of the corresponding variables; λ_i is the coefficient set corresponding to the control variable set; and ε_{it} is an error term that follows a normal distribution.

Second, to test the nonlinear relationship between R&D investment capitalisation and current and future enterprise value, this study used the threshold effect model as follows:

$$\begin{aligned} TobinQ_{it} = {} & \mu_i + \partial RDTA_{it} + \beta_1 Ratio_{it} \cdot I(Fin_{it} < \gamma_1) \\ & + \beta_2 Ratio_{it} \cdot I(Fin_{it} \geq \gamma_1) + \theta CV_{it} + \varepsilon_{it} \end{aligned} \tag{31}$$

$$TobinQ_{it+1} = \mu_i + \partial^1 RDTA_{it} + \beta_1^1 Ratio_{it} \cdot I\left(Fin_{it} < \gamma_1^1\right) + \beta_2^1 Ratio_{it} \cdot I\left(Fin_{it} \geq \gamma_1^1\right) + \rho^1 TobinQ_{it} + \theta^1 CV_{it} + \varepsilon_{it}, \quad (32)$$

where i represents the company; t represents the year; ∂, ∂^1, β_i, β_i^1, ρ^1, θ, θ^1 are the coefficients of the corresponding variables, respectively; $I(\cdot)$ is the indicative function; γ_i, γ_i^1 is the threshold value of the corresponding variable; μ_i is used to reflect the individual effects of the enterprise, such as unobservable factors like corporate culture; and ε_{it} is a random interference term that is independently and identically distributed.

Taking Model (31) as an example, it can be simplified to

$$TobinQ_{it} = \mu_i + \partial RDTA_{it} + \beta Ratio_{it}(\gamma) + \theta CV_{it} + \varepsilon_{it}, \quad (33)$$

where $\beta = \begin{pmatrix} \beta_1 \\ \beta_2 \end{pmatrix}$, $Ratio_{it}(\gamma) = \begin{pmatrix} Ratio_{it} \cdot I(Fin_{it} < \gamma_1) \\ Ratio_{it} \cdot I(Fin_{it} \geq \gamma_1) \end{pmatrix}$. The model presented here is a single-threshold model. When multiple thresholds exist, the model can be adjusted to

$$TobinQ_{it} = \mu_i + \partial RDTA_{it} + \beta Ratio_{it}(\gamma) + \theta CV_{it} + \varepsilon_{it}, \quad (34)$$

where $\beta = \begin{pmatrix} \beta_1 \\ \beta_2 \\ \cdots \\ \beta_i \end{pmatrix}$, $Ratio_{it}(\gamma) = \begin{pmatrix} Ratio_{it} \cdot I(Fin_{it} < \gamma_1) \\ Ratio_{it} \cdot I(\gamma_1 \leq Fin_{it} < \gamma_2) \\ \vdots \\ Ratio_{it} \cdot I(\gamma_{i-1} \leq Fin_{it} < \gamma_i) \\ Ratio_{it} \cdot I(Fin_{it} \geq \gamma_i) \end{pmatrix}$.

Model (32) can be similarly computed.

4. Empirical analysis and results

4.1. Descriptive statistical results

Table 2 shows the results of the descriptive statistical analysis of the relevant variables. The mean value of R&D investment (*RDTA*) is 0.025, indicating that the overall intensity of the sample firms' R&D investment is not high. The standard deviation is 0.0237, and the range is 0.803, indicating significant differences in R&D investment intensity and serious polarisation among the sample firms. The average R&D investment capitalisation rate (*Ratio*) is 0.269, indicating that the rate of R&D investment capitalisation is low for the sample firms. The level of R&D investment capitalisation is not high in China's listed firms. Moreover, in the sample firms, there is a large gap in the capitalisation of R&D investment.

4.2. Total effect test

Table 3 shows the panel regression test results of the capitalisation of sample enterprises' R&D investment on enterprise value. Among them, (1) is listed as the current

Table 2. Descriptive statistics.

Variable	Sample size	Mean value	Standard deviation	Minimum value	Maximum value
RDTA	11,823	0.025	0.024	1.70e-06	0.803
Ratio	11,823	0.269	0.196	8.99e-07	1
TobinQ1	11,823	2.227	1.574	0.0176	31.40
TobinQ2	11,823	2.780	2.221	0.0214	34.01
Size	11,823	22.29	1.280	18.50	28.42
Lev	11,823	0.404	0.190	0.014	1.501
Roe	11,823	0.067	0.146	−4.320	1.726
Dev	11,823	0.171	3.701	−61.25	312.4
Age	11,823	17.41	5.545	2	40
Own	11,823	0.329	0.144	0.029	0.891
Man	11,823	0.148	0.194	0	0.892
Dual	11,823	0.286	0.452	0	1

Note: RDTA = Research and development investment intensity.
Source: the annual reports of listed companies and the China Stock Market & Accounting Research(CSMAR) database.

Table 3. Regression results of capitalisation of R&D investment and firm value.

Variable	(1) $TobinQ1_t$	(2) $TobinQ1_{t+1}$	(3) $TobinQ2_{t+2}$
Ratio	0.596***	0.574***	0.041
	(6.88)	(6.00)	(0.51)
RDTA	8.028***	−3.282***	0.462
	(10.43)	(-3.88)	(0.55)
Size	−0.644***	−0.109***	0.272***
	(-18.51)	(-2.68)	(7.74)
Lev	0.386***	0.086	0.087
	(3.00)	(0.59)	(0.69)
Roe	0.715***	0.017	−0.262***
	(8.63)	(0.17)	(-2.92)
Dev	−0.006**	0.004	−0.002
	(-2.31)	(1.26)	(-0.95)
Age	0.07***	−0.171***	−0.034***
	(8.77)	(-17.64)	(-3.58)
Own	−0.403*	0.583**	0.127
	(-1.71)	(2.12)	(0.52)
Man	−0.614***	0.177	0.275*
	(-3.85)	(0.96)	(1.70)
Dual	−0.059	−0.100**	0.026
	(-1.59)	(-2.34)	(0.67)
$TobinQ1_t$		0.316***	
		(26.62)	
$TobinQ1_{t+1}$			0.319***
			(33.68)
$TobinQ2_{t+2}$			
N	11,802	10,116	8,430
R^2	0.247	0.294	0.267

Note: The data in the table are regression coefficients; and their respective T values are in the brackets; ***, **, and * represent significance at the 1%, 5%, and 10% levels, respectively.
Source: the annual reports of listed companies and the China Stock Market & Accounting Research(CSMAR) database.

firm value regression results, and (2) and (3) are listed as the future phase I and phase II firm value regression results, respectively. In Column (1), the *ratio* regression coefficient is 0.596, which is significant at the 1% level. The results show that when the capitalisation rate of firm R&D investment increases by 1 percentage point, current enterprise value will increase by 0.596 percentage points. At the 1% level, the *RDTA* regression coefficient is significantly positive. This means that when other variables remain unchanged, the firm value in the current period increases by 8.028% as

Table 4. Results of the threshold effect test.

	Threshold test	F value	P value	Critical value (10%, 5%, 1%)
Model (31)	Single threshold	54.34	0.000	(15.063,18.618,25.972)
	Double threshold	19.07	0.042	(14.814,18.158,27.782)
	Triple threshold	12.30	0.948	(43.354,48.156,58.421)
Model (32)	Single threshold	118.42	0.000	(25.611,31.772,39.244)
	Double threshold	27.19	0.082	(25.535,29.230,37.242)
	Triple threshold	29.81	0.582	(48.211,55.166,64.459)

Note: P value is the result obtained by repeated sampling, 500 times with the bootstrap method; ***, **, and * represent significance at the 1%, 5%, and 10% levels, respectively.
Source: the annual reports of listed companies and the China Stock Market & Accounting Research(CSMAR) database.

the intensity of R&D investment increases by 1%. Thus, as the R&D investment and capitalisation degree of R&D investment increase, the enterprise value increases proportionately. H1 is thus verified.

In Column (1), at the 1% level, the *RDTA* regression coefficient is significantly positive, whereas in Column (2), it has a significantly negative influence on firm value at the 1% level. In Column (3), the *RDTA* regression coefficient has no significant influence on firm value. The results indicate that listed firms' R&D investment can significantly increase the firm value for the current period. However, over time, whether R&D investment can really be transformed into firm value depends on the capitalisation part of R&D investment, whereas the expense part may declare R&D a failure, resulting in a decline in firm value.

In Column (2), the *ratio* regression coefficient is significant at the 1% level, whereas it is statistically insignificant in Column (3). Thus, the capitalisation level of R&D investment of listed firms has an impact on enterprise value in future phase I but not in phase II. The results show that the effect of the R&D investment capitalisation level of listed firms on value lags by one period; thus, H2 is verified.

Comparing the *ratio* regression coefficients in Columns (1, 2), and (3), it is found that $0.596 > 0.574 > 0.041$, and the future phase II is not statistically significant. The results indicate that the degree to which the capitalisation of R&D investment affects firm value gradually decreases; thus, H3 is verified.

The results of regression analysis indicate that in comparison with R&D investment, the capitalisation of R&D investment is a better indicator of enterprise value. Therefore, we study the relevance of the capitalisation of R&D investment and enterprise value through a threshold effect test.

4.3. Threshold effect test

Based on the sample data, this study adopted the bootstrap method to test the threshold effect of the capitalisation of R&D investment and enterprise value, taking the level of enterprise financialisation as the threshold variable. Table 4 presents the results of the threshold effect test. According to Table 4, Models (31) and (32) have significant threshold utility, and H4 and H5 are verified. Specifically, when the enterprise financialisation level is taken as the threshold variable, the capitalisation of R&D investment has a double threshold effect at the 5% significance level on the current enterprise value, and the capitalisation of R&D investment has a double threshold effect at the 10% significance level on the future enterprise value.

Table 5. Threshold estimated value.

		Threshold value	Confidence interval
Model (31)	γ_1	0.013	[0.011,0.013]
	γ_2	0.098	[0.096,0.100]
Model (32)	γ_1^1	0.0003	[0.0003,0.0004]
	γ_2^1	0.178	[0.174,0.185]

Source: the annual reports of listed companies and the China Stock Market & Accounting Research(CSMAR) database.

Table 6. Results of the regression analysis with the threshold model.

Variable	Coefficient	t	Variable	Coefficient	t
RDTA	6.744*	1.94	*RDTA*	−0.493	−0.17
Size	−0.633***	−6.26	*Size*	−0.458***	−5.42
Lev	0.135	0.54	*Lev*	0.758***	2.88
Roe	0.628***	3.77	*Roe*	0.108	0.88
Dev	−0.003	−0.45	*Dev*	0.000	0.01
Age	−0.067***	−4.87	*Age*	−0.109***	−8.30
Own	−0.717*	−1.84	*Own*	0.947*	1.91
Man	−0.516**	−2.06	*Man*	0.078	0.30
Dual	−0.056	−1.16	*Dual*	−0.110**	−2.20
			$TobinQ1_t$	0.200***	5.55
Ratio	1.491***	3.88	*Ratio*	2.822***	3.16
$Fin \in$ (min,0.013)			$Fin \in$ (min,0.0003)		
Ratio	0.646***	3.31	*Ratio*	0.337*	1.88
$Fin \in$ (0.013,0.098)			$Fin \in$ (0.0003,0.178)		
Ratio	0.272*	1.92	*Ratio*	0.862***	4.50
$Fin \in$ (0.098,max)			$Fin \in$ (0.178,max)		

Note: ***, **, and * represent significance at the 1%, 5%, and 10% levels, respectively.
Source: the annual reports of listed companies and the China Stock Market & Accounting Research(CSMAR) database.

Table 5 shows the threshold value at 95% confidence interval corresponding to the dual threshold effect of R&D investment capitalisation on the current and future enterprise value with the enterprise financialisation level as the threshold variable.

According to the threshold effect test results, the threshold regression between the capitalisation of R&D investment and the enterprise value of the current and future periods yields the estimation results of the correlation coefficients as shown in Table 6. The regression of Model (31) shows that when the enterprise's financialisation level is lower than 1.3%, the impact of R&D investment capitalisation on the current enterprise value is significantly positive at the 1% level. Thus, in this financialisation level range, for every 1% increase in R&D investment capitalisation rate, the current enterprise value will increase by 1.491%. When the enterprise's financial level is higher than 1.3% and lower than 9.8%, the impact of R&D investment capitalisation on the current enterprise value is significantly positive at the 1% level. In this financial level range, the current enterprise value will increase by 0.646% for every 1% increase in R&D investment capitalisation rate. When the enterprise's financialisation level exceeds 9.8%, the impact of R&D investment capitalisation on the current enterprise value is positive and significant at the 10% level. The regression of Model (32) shows that when the enterprise's financialisation level is lower than 0.03%, the impact of R&D investment capitalisation on the enterprise value in the next phase is significantly positive at the 1% level. In this financialisation level range, for every 1% increase in R&D investment capitalisation rate, the enterprise value in the next phase will increase by 2.822%. When the enterprise's financialisation level is higher than 0.03% and lower than 17.8%, the impact of R&D investment capitalisation on the enterprise value in the next phase is significantly positive at the 10% level. In this financialisation level range, for every 1% increase in R&D investment capitalisation rate, the enterprise value in the next phase will increase by 0.337%. When the enterprise's financialisation level exceeds 17.8%, the impact of R&D investment capitalisation on the enterprise value in the next phase is significantly positive at the 1% level. In this financialisation level range, for every 1% increase in R&D investment capitalisation rate, the enterprise value will increase in the next phase by 0.862%.

In summary, when the level of enterprise financialisation is taken as the threshold variable, there is a threshold effect on the promotion of R&D investment on enterprise value. Specifically, with the improvement of the financialisation level range, the promotion degree of R&D investment in the current enterprise value decreases and its significance becomes weaker. In the current period, the financialisation behaviour of enterprises occupies R&D investment funds, affects the capitalisation efficiency of R&D investment, and the promotion effect on the current enterprise value will decrease with the improvement of the financialisation level. At the same time, the impact of enterprise financial investment behaviour on capitalised R&D investment lags behind. In the next phase, the promotion intensity of R&D investment capitalisation on enterprise value is significantly higher than that in the current period, but the promotion intensity of R&D investment capitalisation on enterprise value is more significant only when the financial level is within a reasonable range. Moreover, the impact of corporate financial investment behaviour on capitalised R&D investment is timely, and the impact on enterprise value in the future phase II is not significant.

4.4. Endogeneity test

Firm value may be affected by unobservable factors related to individual firm characteristics. Moreover, the capitalisation of R&D investment and firm value may have mutual endogeneity problems. To ensure the stability of the research conclusions, this study addressed endogeneity problems using external instrumental variables.

Drawing on Lev and Sougiannis (1996), to control for endogeneity, we selected the average R&D investment capitalisation rate of other companies in the industry as the instrumental variable. This rate is positively correlated with that of other companies, because an increase in other companies' rate drives the firm to increase its own rate. At the same time, the average of other companies' R&D investment capitalisation rate is not affected by that of a single firm and is exogenous. Therefore, we selected the average R&D investment capitalisation rate of other companies in the industry as the instrumental variable and used the two-stage least square (2SLS) method to test it.

The results are shown in Table 7. The correlation test of instrumental variables shows that the Anderson canon. corr. LM statistic p value is less than 0.1, thus rejecting the null hypothesis of insufficient identification of the instrumental variable; as the Cragg–Donald Wald F statistic (353.474) is greater than 16.38, the null hypothesis of weak instrumental variables can also be rejected. The results indicate that the selection of instrumental variables is appropriate. The regression coefficient of the capitalisation rate of R&D investment is consistent with the benchmark regression results

Table 7. Regression results of endogeneity test.

Variable	IV-2SLS $TobinQ_{it}$
Ratio	0.310***
	(7.51)
CV	*Yes*
Industry	*Yes*
Year	*Yes*
Centred-R^2	0.122
Anderson cannon. corr. LM statistic p value	0.000
Cragg–Donald Wald F statistic	353.474
	(16.38)

Note: *** represents significance at the 1% level.
Source: the annual reports of listed companies and the China Stock Market & Accounting Research(CSMAR) database.

and still significantly positive. The results show that the conclusions of this study are reliable.

4.5. Robustness tests

To obtain more robust research conclusions, two robustness tests were conducted. First, the ratio of the company's R&D investment to the enterprise's operating income was used to calculate the R&D investment intensity, and a more consistent regression result was obtained. Second, TobinQ2 was used to measure the enterprise value, threshold regression was conducted on the samples to test robustness, and more consistent results were obtained.

4.6. Further research

According to the previous theoretical analysis, enterprises' financial asset investment can contribute to enterprise value in two ways. First, based on the principal–agent theory, enterprise managers increase enterprise profits and enhance short-term profitability through allocation in high-yield financial assets to increase enterprise value. Second, enterprise managers choose to allocate to those financial assets that may generate income to feed R&D investment or occupy R&D funds, promote or inhibit R&D innovation, and affect enterprise value. To further clarify which pathway is dominant, this study tested the two mechanisms.

4.6.1. Financial level, profitability, and enterprise value

With reference to Du et al. (2017), this study constructed three models to demonstrate the action mechanism of financialisation level on enterprise value. Model (35) was used to test the impact of financialisation level on enterprise value. According to Du et al. (2017), if ϑ_1 is significant, the reuse models, (36) and (37), are used to test the effect of financialisation level on the intermediary variable (i.e. return on net assets (Roe_{it})). If ρ_1 is significant, the enterprise will obtain income through the allocation of financial assets, increase its profit, and improve short-term profitability. Finally, Model (38) is used for testing whether τ_1 and τ_2 are significant, indicating some intermediary effects in the motivation of enterprise financialisation; if τ_1 is not

Table 8. Regression results of financialisation level, profitability, and firm value.

Variable	$TobinQ_{it}$	Roe_{it}
Fin	0.754***	0.006
	(3.35)	(0.22)
CV	*Yes*	*Yes*
Industry	*Yes*	*Yes*
Year	*Yes*	*Yes*
R^2	0.236	0.107

Note: *** represent significance at the 1% level.
Source: the annual reports of listed companies and the China Stock Market & Accounting Research(CSMAR) database.

Table 9. Regression results of financialisation level, capitalisation R&D investment, and firm value.

Variable	(1) $TobinQ_{it}$	(2) $Ratio_{it}$	(3) $TobinQ_{it}$
Fin	0.754***	−0.06**	0.787***
	(3.35)	(-2.23)	(3.51)
Ratio			0.593***
			(6.81)
CV	*Yes*	*Yes*	*Yes*
Industry	*Yes*	*Yes*	*Yes*
Year	*Yes*	*Yes*	*Yes*
R^2	0.236	0.085	0.240

Note: ***, ** represent significance at the 1% and 5% levels, respectively.
Source: the annual reports of listed companies and the China Stock Market & Accounting Research(CSMAR) database.

significant and τ_2 is significant, a complete intermediary effect is indicated; if τ_1 and τ_2 are both not significant, there will be no intermediary effect.

$$TobinQ_{it} = \vartheta_0 + \vartheta_1 Fin_{it} + \vartheta_2 CV_{it} + Industry + Year + \varepsilon_{it} \tag{35}$$

$$Roe_{it} = \rho_0 + \rho_1 Fin_{it} + \rho_2 CV_{it} + Industry + Year + \varepsilon_{it} \tag{36}$$

and

$$TobinQ_{it} = \tau_0 + \tau_1 Fin_{it} + \tau_2 Roe_{it} + \tau_3 CV_{it} + Industry + Year + \varepsilon_{it} \tag{37}$$

The regression results are listed in Table 8. The regression coefficient ϑ_1 is 0.754 significantly positive at the 1% level. The regression coefficient ρ_1 is 0.006, and it is insignificant. The regression results show no significant intermediary effect for enterprises to increase short-term profits and enhance enterprise value by improving the financialisation level.

4.6.2. Financial level, capitalised R&D investment, and enterprise value

A model was developed to test the intermediary effect of capitalised R&D investment, using the same test procedure as mentioned above. The regression results are listed in Table 9. In Column (1) of Table 9, the estimated coefficient of financialisation level (*Fin*) is approximately 0.754 and significant at the 1% level. In Column (2), the estimated coefficient of the impact of financialisation level (*Fin*) on the intermediate variable, capitalised R&D investment (*Ratio*), is −0.06 and significant at the 5% level. In Column (3), the influence coefficients of financialisation level and capitalised R&D

investment on enterprise value are significantly positive at the 1% level. The regression results show that the level of enterprise financialisation affects enterprise value through capitalised R&D investment.

$$TobinQ_{it} = \vartheta_0 + \vartheta_1 Fin_{it} + \vartheta_2 CV_{it} + Industry + Year + \varepsilon_{it} \tag{38}$$

$$Ratio_{it} = \rho_0 + \rho_1 Fin_{it} + \rho_2 CV_{it} + Industry + Year + \varepsilon_{it} \tag{39}$$

and,

$$TobinQ_{it} = \tau_0 + \tau_1 Fin_{it} + \tau_2 Ratio_{it} + \tau_3 CV_{it} + Industry + Year + \varepsilon_{it} \qquad (40).$$

In summary, enterprises choose to allocate financial assets for increasing capitalised R&D investment to promote enterprise value in the long run. The results show that China's policy of promoting R&D and innovation of entity enterprises and obtaining high-quality long-term development has achieved results and that enterprises are gradually developing.

5. Conclusions and implications

Taking the A-share listed companies that disclosed the capitalisation of R&D investment in Shanghai and Shenzhen stock markets from 2014 to 2020 as the research sample, this study empirically examined the impact of R&D investment capitalisation on the enterprise value and further tested the threshold effect of R&D investment capitalisation on the enterprise value while considering the financialisation level as the threshold variable. At the same time, it also discussed the main path of the impact of financialisation level on enterprise value. The results showed that the capitalisation of R&D investment positively impacts the enterprise value in the current as well as future periods. However, the effect on the enterprise value in the current period is higher than that in the future period. When the financialisation level is taken as the threshold variable, the capitalisation of R&D investment has a double threshold effect on the current enterprise value. the financialisation behaviour of enterprises in the current period is to occupy R&D investment funds. This affects the capitalisation efficiency of R&D investment, and the promotion effect on the current enterprise value decreases with an improvement in the financialisation level. When the financialisation level is taken as the threshold variable, the capitalisation of R&D investment also has a double threshold effect on the enterprise value in the next phase, and the enterprise financial investment behaviour lags behind. The promotion intensity of R&D investment capitalisation in the next phase is significantly higher than that in the current period. Furthermore, only when the financialisation level is within a reasonable range is the promotion intensity of R&D investment capitalisation on enterprise value more significant. Moreover, the impact of corporate financial investment behaviour on capitalised R&D investment is timely, and the impact on phase II enterprises in the future is not significant. By further comparing the action path of financialisation level on enterprise value, we found that enterprises choose financial investment not to increase enterprise profits and promote enterprise value in the short term but to enhance enterprise value by increasing capitalised R&D investment.

The following key conclusions emerge. First, most enterprises mainly focus on R&D investment but ignore the capitalised R&D investment, which can better reflect enterprise value. Only by continuously improving R&D efficiency can the enterprise value be improved. Second, to maximise the promotion of enterprise value, managers should reasonably formulate financial asset investment plans according to the actual situation of the enterprise. This will prevent the excessive financialisation and consumption of R&D funds to inhibit the promotion of the enterprise value. At the same time, the enterprise management should invest in financial assets rationally and must focus on R&D innovation and the real economy and on improving the hard power of the enterprise, rather than on short-term speculative income, as the final gain outweighs the loss. Finally, the government should standardise the financial investment behaviour of enterprises, guide them to focus on innovation and the real economy, and help them develop from virtual to real enterprises. This will allow the realisation of a virtuous circle in the market and promote economic growth.

A limitation of this study is that it did not subdivide the industries and managers' characteristics, and several other research directions may need to be explored. Different kinds of enterprises have different financialisation level needs, and different managers have different risk preferences. By subdividing the characteristics of enterprises and managers, future researchers may obtain more accurate results. Nevertheless, our findings contribute to the thriving debate surrounding the characteristics of enterprises and management.

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