Research on the relationship among supply chain concentration ratio, R&D investment and enterprise performance

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Abstract: *This paper takes the listed companies from 2016 to 2020 as the research object and uses the Intermediary effect model to explore the relationship among supply chain concentration ratio, R&D investment, and enterprise performance. The research finds that supply chain concentration ratio has an inhibitory effect on enterprise performance, and R&D investment plays a partial mediating role between the two variables. Based on this, this paper believes that enterprises can formulate appropriate supply chain concentration ratio according to their own business situation and market position; Strengthen supply chain relationship management, reduce information asymmetry while fully utilizing heterogeneous innovation resources brought by the supply chain; Establish a supply chain supervision and management mechanism to avoid the adverse impact of too high concentration of supply chain, so as to improve the investment of enterprises in innovation and R&D, and then enterprise performance.*

Keywords: *R&D investment; Supply chain concentration ratio; Enterprise performance*

1. Introduction

In the context of a new round of technological revolution and industrial revolution in the ascendant era, enterprises, as the main body of innovation in China, should continue to increase innovation and research and development, acquire core competitiveness, break free from the low-end dilemma of the value chain, and achieve high-quality development of enterprises. However, with the intensification of market competition, internal resources of enterprises have become highly civilized, and problems such as insufficient reserves of scientific and technological talents, low efficiency in transforming innovative achievements, and ineffective turnover of research and development funds have emerged. This has prompted enterprises to pay attention to supply chain relationship management, to obtain innovative external resources brought by upstream suppliers and downstream tourists, and further improve enterprise performance(Guo,2022)[1]. As the key of supply chain management, supply chain concentration ratio, on the one hand, reflects the number of suppliers and customers that enterprises cooperate with[2], thus affecting the heterogeneity of external innovation resources that enterprises can access; On the other hand, the supply chain concentration ratio also represents the closeness and stability of cooperation between enterprises and suppliers and customers[1], which has a certain impact on the business environment and innovation decisions of enterprises. Based on this, this paper takes a share listed companies from 2016 to 2020 as the research object, uses the Intermediary effect model to explore the relationship and mechanism of supply chain concentration ratio, R&D investment, and enterprise performance. While enriching the empirical research content in this field, it is expected to provide reasonable and effective reference for enterprises to strengthen supply chain relationship management, reasonably optimize supply chain concentration ratio, and improve enterprise performance.

2. Theory and hypotheses

2.1. Supply chain concentration ratio and enterprise performance

Coase's cost transaction theory proposes that in daily production and operation, various transaction activities carried out by enterprises will inevitably generate transaction costs for the enterprise. The Porter Five Forces model also points out that the bargaining power of suppliers and buyers can affect the business development of enterprises. On the one hand, the improvement of supply chain concentration ratio will increase the transaction costs of bargaining between suppliers and customers over transaction

contracts, prices, and product quality. On the other hand, the improvement of concentration ratio of the supply chain will also enhance the dependence of enterprises on suppliers and customers, thus prompting enterprises to pay more attention to the requirements of suppliers and customers. Based on the maximization of their respective interests, suppliers will demand an increase in the purchase price of raw materials and a reduction in the quality of products/services, while customers will demand that enterprises reduce sales prices and improve the quality of products/services. These unreasonable requirements not only increase the procurement and production costs of enterprises, but also reduce their sales revenue, ultimately leading to a decline in enterprise performance.

Based on this, this article proposes the following assumptions:

H1: With other relevant factors unchanged, customer concentration ratio has a negative effect on enterprise performance.

H2: With other relevant factors unchanged, supplier concentration ratio has a negative inhibitory effect on enterprise performance.

2.2. Supply chain concentration ratio, R&D investment, and enterprise performance

2.2.1. Supply chain concentration ratio and R&D investment

The funds invested in R&D by enterprises mostly come from internal financing channels such as profit retention. When the concentration ratio of the supply chain is high, suppliers and customers will rely on their strong bargaining power to take a series of opportunism behaviors in the process of trading with enterprises, which will occupy the profit space of enterprises and increase the business risk of enterprises (Wan,2020)[3]. To maintain its existing market share and competitive advantage, enterprises must cater to unreasonable demands from suppliers and customers and hold relatively higher levels of cash holdings in the business process to ensure the fulfillment of commitments and the realization of preventive needs (Zhao,2014)[4], thereby affecting the investment of enterprises in innovation and research and development. In addition, the heterogeneous resources owned by customers and suppliers are beneficial for the development of enterprise innovation projects (Ding,2022)[5] . However, when the concentration ratio of the supply chain is high, the heterogeneous resources that enterprises can obtain from the upstream and downstream of the supply chain are reduced, which now refers to the intensity of enterprises' R&D investment.

Based on this assumption, this article proposes the following assumptions:

H3: With other relevant factors unchanged, customer concentration ratio has a negative effect on R&D investment.

H4: With other relevant factors unchanged, supplier concentration ratio has a positive effect on R&D investment.

2.2.2. R&D investment and enterprise performance

Schumpeter's innovation theory believes that new products, technologies, and other new resources can help enterprises maximize excess profits. Therefore, innovation is the driving force for economic growth and development of enterprises. Without innovation, enterprises cannot develop for a long time (Schumpeter,2009)[6]. R&D investment, as an important means of enterprise innovation, can bring scarce and difficult to replace resources for enterprises, thereby helping them to be in an advantageous position in market competition and ultimately achieving growth in enterprise performance (Li,2013)[7].

Based on this assumption, this article proposes the following assumptions:

H5: R&D investment has a positive promoting effect on corporate performance, while other relevant factors remain unchanged.

2.2.3. The intermediary role of research and development investment

Based on the above analysis of the relationship between supply chain concentration ratio, R&D investment and enterprise performance, it can be seen that when the concentration ratio of the enterprise supply chain increases, the bargaining power between tour suppliers and customers increases, prompting them to adopt opportunism behavior in the transaction process to safeguard their own interests; The increase in transaction costs on the enterprise side will result in a decrease in profits available, which will squeeze out the funds used by the enterprise for innovative research and development. In addition, when the concentration of supply chain is too high, the heterogeneous innovation resources that enterprises

obtain from external stakeholders will also be reduced, thus limiting the intensity of enterprises' R&D investment. In summary, the innovation and research and development of enterprises have decreased, resulting in insufficient development momentum, and ultimately leading to a decrease in enterprise performance.

Based on this, this article proposes the following assumptions

H6: With other relevant factors unchanged, R&D investment has a positive mediating effect between customer concentration ratio and enterprise performance.

H7: With other relevant factors unchanged, R&D investment has a positive mediating effect between supplier chain concentration ratio and enterprise performance.

Based on the above research assumptions, the theoretical hypothesis model of this study is shown in Figure 1.
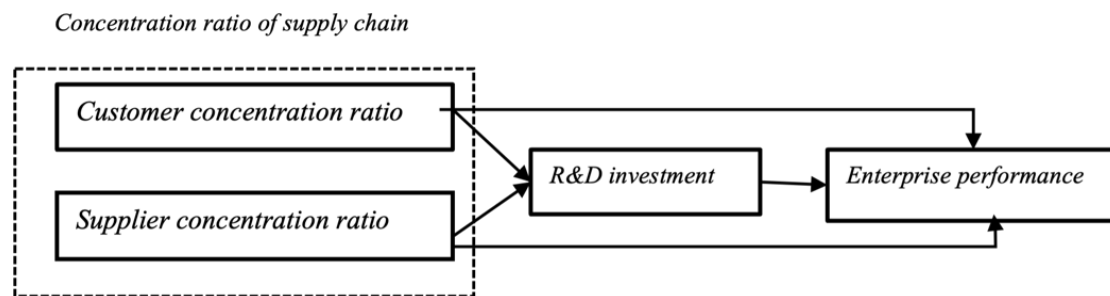

Figure 1: Theoretical Assumption Module

3. Method

3.1. Sample selection and data sources

Supply chain concentration ratio includes two measurement dimensions: upstream supplier concentration ratio and downstream customer concentration ratio. This paper uses the practices of most scholars to measure customer concentration ratio (CC) and supplier concentration ratio (SC) by using the sales proportion of the top five customers and the purchase proportion of the top five suppliers. In addition, some scholars based on the integration thought proposed that the impact of supply chain concentration ratio on enterprise R&D investment and operating performance is caused by the joint action of suppliers and customers, and should not be measured in dimensions (Wang,2021)[8]. Therefore, this paper replaces the measurement index of supply chain concentration ratio with the mean value of the sum of the top five suppliers and customers' purchase and sales ratios for robustness test.

3.2. Variable setting and measurement

3.2.1. Concentration ratio of supply chain

Supply chain concentration ratio includes two measurement dimensions: upstream supplier concentration ratio and downstream customer concentration ratio. This paper uses the practices of most scholars to measure customer concentration ratio (CC) and supplier concentration ratio (SC) by using the sales proportion of the top five customers and the purchase proportion of the top five suppliers. In addition, some scholars based on the integration thought proposed that the impact of supply chain concentration ratio on enterprise R&D investment and operating performance is caused by the joint action of suppliers and customers, and should not be measured in dimensions (Wang,2021)[8]. Therefore, this paper replaces the measurement index of supply chain concentration ratio with the mean value of the sum of the top five suppliers and customers' purchase and sales ratios for robustness test.

3.2.2. R&D investment

At present, scholars mainly divide the measurement methods of R&D investment into two types: ① the proportion of annual R&D expenditure to total assets; ② the proportion of annual R&D expenditure to operating revenue (Xu,2021)[9]. Given the availability of data, this article selects the ratio of R&D expenditure to previous period operating income to measure the company's R&D investment (RD).

3.2.3. Enterprise performance

There are many ways to measure enterprise performance, such as total return on assets (ROA), net return on assets (ROA), Tobin Q value, etc. This paper uses the total return on assets (ROA) commonly used by scholars as a measure of enterprise performance.

3.2.4. Control variables

To better explore the relationship between supply chain concentration ratio, R&D investment, and enterprise performance. By reviewing relevant literature, this paper selects asset size, asset liability ratio, total Asset turnover, age of listing, equity concentration ratio, and equity balance as control variables, and controls the fixed effects brought by year and industry in the model.

3.3. Model construction

To test the relationship between supply chain concentration ratio and enterprise performance, and whether R&D investment plays a mediating role in this mechanism, this paper uses the Intermediary effect model.

$$Roa = a_0 + a_1CC + a_2Size + a_3Lev + a_4Ato + a_5Age + a_6Top1 + a_7Balance + \sum Year + \sum Industry + \varepsilon \tag{1}$$

$$Roa = b_0 + b_1SC + b_2Size + b_3Lev + b_4Ato + b_5Age + b_6Top1 + b_7Balance + \sum Year + \sum Industry + \varepsilon \tag{2}$$

$$RD = c_0 + c_1CC + c_2Size + c_3Lev + c_4Ato + c_5Age + c_6Top1 + c_7Balance + \sum Year + \sum Industry + \varepsilon \tag{3}$$

$$RD = d_0 + d_1SC + d_2Size + d_3Lev + d_4Ato + d_5Age + d_6Top1 + d_7Balance + \sum Year + \sum Industry + \varepsilon \tag{4}$$

$$Roa = e_0 + e_1RD + e_2Size + e_3Lev + e_4Ato + e_5Age + e_6Top1 + e_7Balance + \sum Year + \sum Industry + \varepsilon \tag{5}$$

$$Roa = f_0 + f_1CC + f_2RD + f_3Size + f_4Lev + f_5Ato + f_6Age + f_7Top1 + f_8Balance + \sum Year + \sum Industry + \varepsilon \tag{6}$$

$$Roa = g_0 + g_1SC + g_2RD + g_3Size + g_4Lev + g_5Ato + g_6Age + g_7Top1 + g_8Balance + \sum Year + \sum Industry + \varepsilon \tag{7}$$

Model (1) and model (2) are benchmark tests, that is, to test the relationship between customer concentration ratio and supplier concentration ratio and enterprise performance, respectively. When the coefficients a_1 and b_1 significantly indicate that H1 and H2 are tenable. Models (3) and (4) respectively test the relationship between customer concentration ratio, supplier concentration ratio and R&D investment. When the coefficients c_1 and d_1 are significant, H3 and H4 are valid. The model (5) is to test the relationship between R&D investment and enterprise performance. When the coefficient e_1 "significantly indicates that H5 is tenable. Model (6) and model (7) are to test the intermediary mechanism of R&D investment. When the coefficient $f_1, f_2(g_1, g_2)$ are significant, and the decline of $f_1(g_1)$ indicates that R&D investment plays a partial Intermediary effect; when only $f_2(g_2)$ is significant, it indicates that R&D investment plays a full Intermediary effect.

4. Empirical analyses

4.1. Descriptive statistical analyses

The descriptive statistical results of the main related variables are shown in Table 1. It can be seen from Table 2 that the maximum value of the total return on assets (ROA) of the selected enterprise sample is 0.206, the minimum value is -0.205, the average value is 0.040, the median is 0.038, and the standard deviation is 0.062. The sample data is normally distributed, and the profitability gap between enterprises is large. The maximum value of customer concentration ratio (CC) is 90.970, the minimum value is 2.120, the average value is 29.416, the median is 24.130, and the standard deviation is 19.888, indicating that the sample enterprise customer concentration ratio varies greatly, and more than half of the enterprise customer concentration ratio is lower than the average. However, the maximum value of supplier concentration ratio (SC) is 86.890, the minimum value is 5.000, the average value is 31.633, and the

median is 27.690. The standard deviation is 17.911, indicating that these listed enterprises have a large gap in supplier concentration ratio, and more than half of enterprise customers have lower concentration ratio than the average. The maximum value of R&D investment (RD) is 0.296, the minimum value is 0.000, the average value is 0.055, the median is 0.042, and the standard deviation is 0.052, indicating that these listed companies attach great importance to R&D investment, but the gap between enterprises is still significant. From the descriptive statistical results of the control variables, due to factors such as industry nature and property structure, there are certain gaps in the scale, profitability, and equity structure of listed companies in China. However, overall, these companies have stable and good profitability.

Table 1: Descriptive Statistics of Variables

time	N	Mean	p50	SD	Min	Max
ROA	8735	0.040	0.038	0.062	-0.205	0.206
CC	8735	29.416	24.130	19.888	2.120	90.970
SC	8735	31.633	27.690	17.911	5.000	86.890
RD	8735	0.055	0.042	0.052	0.000	0.296
Size	8735	22.444	22.285	1.207	20.175	25.782
Lev	8735	0.410	0.406	0.186	0.065	0.845
ATO	8735	0.627	0.544	0.379	0.107	2.344
Age	8735	2.337	2.303	0.602	0.693	3.258
Top1	8735	0.320	0.300	0.139	0.091	0.693
Balance	8735	0.770	0.607	0.598	0.043	2.648

4.2. Correlation analyses

The correlation analysis results of the main variables are shown in Table 2. The correlation coefficient between customer concentration ratio and enterprise performance is -0.106, which is significant at the level of 1%, indicating that the greater the customer concentration ratio, the worse the enterprise performance, in line with H1. The correlation coefficient between supplier concentration ratio and enterprise performance is -0.024, which is significant at the level of 5%, indicating that the greater the supplier concentration ratio, the worse the enterprise performance, in line with H2. The correlation coefficient between customer concentration ratio and R&D investment is -0.027, which is significant at the level of 5%, indicating that the more customer concentration ratio is,7 high, the lower the R&D investment of the enterprise, which is consistent with H3. The correlation coefficient between supplier concentration ratio and R&D investment is -0.019, and it is significant at the 10% level, indicating that the higher the supplier concentration ratio, the less the enterprise R&D investment, which conforms to H4. The correlation coefficient between R&D investment and corporate performance is 0.028, which is significant at the 1% level, indicating that an increase in R&D investment is conducive to the growth of corporate performance, in line with H5, and thus meets the mediating effect validation condition. In addition, the correlation coefficient among the selected variables is less than 0.7, and the significance is good, indicating that there is correlation between the control variable, the explained variable and the explanatory variable, and there is no multicollinearity among the variables, so the selected control variable is reasonable.

Table 2: Variable correlation analysis

Variable	ROA	CC	SC	RD	Size	Lev	ATO	Age	Top1	Balance
ROA	1									
CC	-0.106***	1								
SC	-0.024**	0.247***	1							
RD	0.028***	-0.027**	-0.019*	1						
Size	0.064***	-0.113***	-0.219***	-0.236***	1					
Lev	-0.304***	-0.00800	-0.170***	-0.263***	0.528***	1				
ATO	0.203***	-0.111***	0.034***	-0.262***	0.128***	0.170***	1			
Age	-0.083***	-0.082***	-0.065***	-0.212***	0.410***	0.262***	0.122***	1		
Top1	0.153***	0.039***	-0.0150	-0.181***	0.187***	0.045***	0.091***	-0.021*	1	
Balance	-0.049***	-0.037***	-0.00300	0.147***	-0.063***	-0.068***	-0.069***	-0.141***	-0.706***	1

t statistics in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

4.3. Regression analyses

Table 3: Multiple regression analysis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	ROA	ROA	RD	RD	ROA	ROA	ROA
CC	-0,005***	-	-0,004***	-	-	-0,004***	-
	(-5.40)	-	(-5.03)	-	-	(-5.05)	-
SC	-	-0,004***		-0,005***	-	-	-0,004***
	-	(-4.13)		(-6.38)	-	-	(-3.66)
RD	-	-	-	-	0,090***	0,086***	0,086***
	-	-	-	-	(5.88)	(5.67)	(5.65)
Size	0,016***	0,017***	-0,000	-0,001	0,017***	0,016***	0,017***
	(23.10)	(23.44)	(-0.92)	(-1.15)	(24.70)	(23.15)	(23.54)
Lev	-0,163***	-0,165***	-0,045***	-0,046***	-0,160***	-0,160***	-0,161***
	(-35.29)	(-35.64)	(-13.57)	(-14.22)	(-34.37)	(-34.24)	(-34.53)
ATO	0,042***	0,043***	-0,025***	-0,024***	0,045***	0,044***	0,045***
	(20.95)	(21.57)	(-20.44)	(-19.65)	(22.26)	(21.87)	(22.43)
Age	-0,010***	-0,010***	-0,008***	-0,008***	-0,009***	-0,009***	-0,009***
	(-9.39)	(-9.21)	(-9.22)	(-9.05)	(-8.62)	(-8.71)	(-8.55)
Top1	0,042***	0,042***	-0,025***	-0,025***	0,044***	0,044***	0,044***
	(6.87)	(6.93)	(-4.83)	(-4.76)	(7.30)	(7.25)	(7.31)
Balance	0,001	0,001	0,002	0,002	0,001	0,001	0,001
	(0.67)	(0.82)	(1.32)	(1.44)	(0.73)	(0.58)	(0.71)
cons	-0,256***	-0,260***	0,103***	0,113***	-0,293***	-0,265***	-0,269***
	(-16.39)	(-16.35)	(9.32)	(9.93)	(-19.95)	(-16.93)	(-16.91)
N	8735	8735	8735	8735	8735	8735	8735
df_m	30,000	30,000	30,000	30,000	30,000	31,000	31,000
F	83,817	83,377	176,324	169,785	83,214	81,682	81,396
r2	0,277	0,276	0,323	0,325	0,278	0,280	0,279
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes

t statistics in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Perform multiple regression analysis on relevant variables based on the established econometric model. The regression results are shown in Table 3. Model (1) explores the relationship between customer concentration ratio and enterprise performance. It can be seen from the table that the impact coefficient of customer concentration ratio on enterprise performance is -0.005, which is significant at the level of 1%. This shows that under the influence of customer concentration ratio, the enterprise performance decreases by 0.005 units on average after controlling other relevant variables unchanged; That is, customer concentration ratio negatively inhibits enterprise performance, which is consistent with H1. Model (2) explores the relationship between supplier concentration ratio and enterprise performance. It can be seen from the table that the impact coefficient of supplier concentration ratio on enterprise performance is -0.004, which is significant at the level of 1%. This shows that under the influence of supplier concentration ratio, the enterprise performance decreases by 0.004 units on average, while other related variables remain unchanged; That is, the concentration ratio of supply line suppliers negatively inhibits the performance of enterprises,8 effects, consistent with H2. Model (3) explores the impact of customer concentration ratio on enterprise R&D investment. It can be seen from the table that the customer concentration ratio coefficient is -0.004, which is significant at the level of 1%. This shows that when the relevant variables remain unchanged, the R&D investment of enterprises decreases by 0.004 units on average under the effect of customer concentration ratio; When the concentration of enterprise customers increases, the R&D investment of the enterprise decreases, which is consistent with H3. Model (4) explores the impact of supplier concentration ratio on enterprise R&D investment. The table shows that the supplier concentration ratio coefficient is -0.005, which is significant at the level of 1%. This shows that when the relevant variables remain unchanged, the R&D investment of enterprises decreases by -0.004 units on average under the effect of supplier concentration ratio; When the improvement of executive compensation and benefits in enterprises is conducive to attracting high-quality talents to join, the model (5) explores the impact of the previous R&D investment on current performance, which is consistent with H4. From the table, the coefficient of impact of the company's previous R&D investment on current performance is 0.090, with a significance level of 1%. This indicates that increasing R&D investment in enterprises can positively promote corporate performance, which is consistent with H5. The regression of model (6) based on the first three models (1), (3) and (5) is to verify whether R&D investment plays a mediating role between customer concentration ratio and enterprise performance. It can be seen from the table that the R&D investment of enterprises and the concentration ratio coefficient of customers are 0.086 and -0.004 respectively, with a significance level of 1%; And the Goodness of fit increased from 0.277 in model (1) to 0.280 in model (6), passing the test of Intermediary effect. To sum

up, R&D investment plays a partial intermediary role between customer concentration ratio and enterprise performance, which is consistent with H6. The regression of model (7) based on the first three models (2), (4) and (5) is to verify whether R&D investment plays a mediating role between supplier concentration ratio and enterprise performance. It can be seen from the table that the supplier concentration ratio and R&D input coefficient are -0.004 and 0.086 respectively, with a significance level of 1%; And the Goodness of fit increased from 0.276 in model (2) to 0.279 in model (7), passing the test of Intermediary effect. To sum up, R&D investment plays a partial intermediary role between supplier concentration ratio and enterprise performance, which is consistent with H7.

4.4. Robustness test

To ensure the robustness of the multiple regression results, this study replaced the measurement index of supply chain concentration ratio with the mean value of the sum of the purchase and sales proportion of the previous five suppliers and customers for regression analysis again. From the robustness regression results shown in Table 4, we can see that supply chain concentration ratio still plays a negative inhibitory role on enterprise performance, and R&D investment still has some Intermediary effect between these two variables, which verifies all the assumptions of the article.

Table 4: Robustness Test

	(1)	(2)	(3)	(4)
	ROA	ROA	RD	ROA
SCC	-0,005***	-	-0,004***	-0,004***
	(-5.40)		(-5.03)	(-5.05)
RD	-	0,090***	-	0,086***
	-	(5.88)	-	(5.67)
Size	0,016***	0,017***	-0,000	0,016***
	(23.10)	(24.70)	(-0.92)	(23.15)
Lev	-0,163***	-0,160***	-0,045***	-0,160***
	(-35.29)	(-34.37)	(-13.57)	(-34.24)
ATO	0,042***	0,045***	-0,025***	0,044***
	(20.95)	(22.26)	(-20.44)	(21.87)
Age	-0,010***	-0,009***	-0,008***	-0,009***
	(-9.39)	(-8.62)	(-9.22)	(-8.71)
Top1	0,042***	0,044***	-0,025***	0,044***
	(6.87)	(7.30)	(-4.83)	(7.25)
Balance	0,001	0,001	0,002	0,001
	(0.67)	(0.73)	(1.32)	(0.58)
_cons	-0,256***	-0,293***	0,103***	-0,265***
	(-16.39)	(-19.95)	(9.32)	(-16.93)
N	8735	8735	8735	8735
df_m	30,000	30,000	30,000	31,000
F	83,817	83,214	176,324	81,682
r2	0,277	0,278	0,323	0,280
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes

t statistics in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

5. Conclusions

This article takes listed companies from 2016 to 2020 as the research object, obtains a total of 8735 research samples through preliminary data screening and sorting. This paper explores how supply chain concentration ratio affects enterprise performance, and the role of R&D investment in this path. The results show that: (1) There is a significant negative correlation between supply chain concentration ratio and enterprise performance. (2) There is a significant negative correlation between supply chain concentration ratio and R&D investment. (3) There is a positive correlation between R&D investment and corporate performance. (4) C R&D investment plays a mediating role between supply chain concentration ratio and enterprise performance.

Based on the above conclusions, this paper obtains the following enlightenment: First, enterprises should choose the appropriate supply chain concentration ratio according to their own characteristics. In business development, enterprises should consider multiple factors such as industry characteristics, market position, and business performance to choose supply chain partners with good development prospects and stable business conditions. Secondly, enterprises should attach importance to supply chain relationship management. Enterprises should strengthen technical cooperation and information exchange

with customers and suppliers in all aspects of production and operation, reduce the negative impact of financing constraints caused by information asymmetry in enterprise research and development innovation, and transform the relationship resources of all parties in the supply chain into competitive advantages for enterprises, thereby enhancing business performance and development strength. Finally, enterprises should establish a supply chain supervision and management mechanism. When conducting transactions and cooperation with customers and suppliers, enterprises should timely monitor their business problems and strategic adjustments to avoid a situation where the deterioration of the enterprise's operations in the supply chain leads to a "pull and pull" situation.

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