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An empirical study on supplier concentration and working capital: the moderating effect of internal control

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Abstract: Working capital is an essential resource for the continuity of corporate operations, and its management is crucial for maintaining a firm's everyday activities. Senior management must prioritise the appropriate management of working capital to ensure the company's long-term stability and sustainable development. This study analyses a data set of 7451 firm-year observations from A-share listed companies on the Shanghai and Shenzhen Stock Exchanges from 2012 to 2019 to evaluate the impact of supplier concentration and internal control on the efficacy of corporate working capital management. The empirical data indicate that increased supplier concentration is associated with a diminished cash conversion cycle, hence improving the efficiency of working capital utilisation. This suggests that fostering robust, cooperative relationships with a select group of essential suppliers might improve cash flow management and accelerate capital turnover. The study additionally reveals that the internal control system positively moderates this association. Implementing strong internal control systems can enhance the beneficial impact of supplier concentration on the effectiveness of working capital management.

Keywords: suppliers; internal control; working capital.

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1 Introduction

Working capital, as one of the most critical financial resources for enterprises, serves as a fundamental pillar in maintaining daily operations and ensuring financial stability. Its management efficiency is directly linked to the sustainability of business operations and the achievement of strategic development goals. Effective working capital management not only reduces financial risk and enhances operational efficiency but also strengthens a firm's competitive advantage, thereby contributing to its sustainable development (Almomani et al., 2021). In today's increasingly competitive market environment, corporate managers are confronted with complex challenges. The acceleration of economic globalisation and rapid technological advancements have significantly increased the uncertainty and diversity of market demand. Enterprises must respond flexibly to external environmental changes while maintaining financial soundness internally. In practice, senior executives often devote considerable time and resources to the management of working capital, highlighting its central role in corporate governance.

Particularly in the post-pandemic era, the global economic recovery remains sluggish, placing many firms under substantial liquidity pressure and increasing the risk of working capital disruptions. These developments have heightened corporate concern regarding the liquidity and efficiency of working capital management (Zimon and Tarighi, 2021). Traditionally, working capital management has focused on isolated components such as inventory, accounts receivable and accounts payable, often neglecting the interdependencies and systemic nature of these elements. However, as the external economic environment evolves, firms have increasingly recognised the pivotal role of supply chain management in optimising working capital allocation (Iqbal and Hayat, 2020). To enhance the efficiency of capital utilisation, an increasing number of enterprises have integrated supply chain considerations into their working capital management frameworks, emphasising collaboration with upstream and downstream partners – especially suppliers – to facilitate systematic and efficient capital turnover (Protopappa-Sieke and Seifert, 2017). Within this context, supplier concentration emerges as a key variable in supply chain management, as its optimal configuration profoundly influences procurement costs, supply stability, inventory turnover and the timing of financial settlements.

Nonetheless, firms often face strategic trade-offs between centralised and decentralised procurement. While centralised procurement can achieve economies of scale and reduce transaction costs, it may also increase financial pressure and supply risk due to over-reliance on a limited number of suppliers. Conversely, decentralised procurement can mitigate dependence-related risks but may lead to higher management

complexity and weakened supply chain coordination. This dilemma underscores the pressing need to explore the relationship between supplier concentration and the efficiency of working capital management. Furthermore, internal control, as a core institutional mechanism of corporate governance, plays a critical role in standardising transaction processes, mitigating information asymmetries and preventing cooperation risks. In the context of supply chain management, a robust internal control system can facilitate the optimisation of supplier management strategies and enhance the efficiency of resource allocation. However, existing research has yet to systematically examine how internal control moderates the relationship between supplier concentration and working capital efficiency, nor has it fully elucidated the underlying logic of their interaction.

Against the backdrop of a deeply restructured global economy and increasingly frequent supply chain disruptions, a comprehensive investigation into the relationship between supplier concentration and working capital management efficiency – while introducing internal control as a moderating variable – offers both theoretical and practical significance. Such research not only enriches the literature on working capital and supply chain governance but also provides valuable guidance for enterprises in formulating procurement strategies and refining internal control mechanisms to enhance capital utilisation efficiency.

2 Theoretical foundation and literature review

2.1 Theoretical foundation

2.1.1 Information asymmetry theory

Information asymmetry is defined as a situation in which one party involved in an economic transaction possesses more or more accurate information than the other party. This imbalance of information has the potential to impact the fairness and efficiency of transactions, and may even result in market failures (Akerlof, 2003). As a core concept in modern economics and finance, the theory of information asymmetry profoundly reveals the complex economic phenomena that arise from differences in information acquisition among market participants. In the business environment, this theory is particularly important as it not only impacts the fairness and efficiency of market transactions but also directly influences the credibility of the company and the quality of supplier management.

As the party with an informational advantage, business operators hold key information concerning the firm's operational status, financial condition and market prospects. This information is often difficult for external suppliers to directly obtain or verify, leading to an unequal footing in transaction negotiations. To mitigate the cooperation barriers caused by such information asymmetry, business operators typically adopt various measures to send positive signals (Du and Yu, 2020) to enhance supplier trust. These signals encompass, but are not restricted to, financial transparency, brand building and reputation management and transparency in supply chain operations. In addition to proactively sending signals, a firm's internal control system is also a crucial reference for external stakeholders to assess the company's actual development situation (Su et al., 2014). An efficient internal control system can guarantee the validity, accuracy and prompt disclosure of company information, thereby mitigating the risks of insider

control and information manipulation (Ajao and Oluwadamilola, 2020; Li et al., 2022). Suppliers can evaluate a company's governance level and operational efficiency by understanding its internal control framework, audit results and risk management measures, enabling them to make more rational decisions.

2.1.2 Stakeholder theory

According to stakeholder theory, while pursuing economic goals, companies must deeply recognise the critical importance of maintaining a diverse, balanced and harmonious network of stakeholders for their long-term success and sustainable development (Boaventura et al., 2020). This theory emphasises that a company is not merely a tool for creating value for shareholders but is instead a complex system that connects and serves a wide range of stakeholders, including suppliers (Pererva et al., 2021). Within this framework, placing the overall interests of stakeholders at the strategic core is a key pathway to maximising a company's overall economic benefits.

As upstream partners of a company, the stability, reliability and innovation capacity of suppliers directly impact the company's production efficiency and product quality (Liu et al., 2018). Therefore, if a company actively safeguards the interests of its suppliers, it not only establishes stable and reliable supply relationships but also gains a competitive advantage in a fiercely contested market, maximising overall economic benefits. This stakeholder-centred management philosophy is the essential path for modern enterprises to achieve sustainable development and long-term success.

2.2 Literature review

2.2.1 Working capital management

The academic investigation of working capital management dates to the 1930s. Thompson and Beranek (1966) advanced the notion of optimisation strategies for essential working capital elements, including as cash, inventories and accounts receivable. As research progressed, Knight (1972) contended that enhancing individual components of working capital does not inherently lead to the optimisation of overall working capital performance. He underscored the importance of implementing a cohesive and systematic strategy for working capital management, moving away from the conventional fragmented viewpoint and initiating a more holistic research framework.

Currently, the literature on working capital management has become extensive and well-developed, and may be broadly categorised into the following core areas:

1) *Research on factors affecting working capital*: Simon et al. (2021) and Phan et al. (2019) investigated the influence of macroeconomic conditions on corporate working capital. Hussain (2021) explored the effects of monetary policy on working capital dynamics. Awaysheh (2020) explored how a company's commitment to social responsibility affects its working capital. Iqbal and Hayat (2020) investigated the impact of customer and supplier concentration on the efficiency of working capital management. Mulyono et al. (2018) investigated how asset quality and reduced debt withdrawals affect working capital management. Aryawan and Indriani (2020) indicated that the management of working capital is affected by the risk attitudes of managers. Gao and Cheng (2017) discovered that the proportion of independent directors on the board, the ratio of pay for the board, supervisory and

senior management, the proportion of supervisors and the extent of managerial ownership all influence corporate working capital.

2) *Research on evaluation indicators for working capital management*: Kaplan et al. (2017) contended that the evaluation of working capital management should extend beyond individual indicators and rely on a holistic and systematic assessment approach. Dhole et al. (2019) proposed that, when evaluating working capital management, it is more relevant to examine the characteristics of working capital and use cash ratio and cash turnover time indicators.

3) *The existing literature on the correlation between working capital management and corporate performance*: It suggests that both working capital management and corporate governance impact corporate performance. The research conducted by Buisman et al. (2019), Kayani et al. (2021) and Akbar et al. (2021) corroborated this assertion.

4) *Research on target working capital*: Rey-Ares et al. (2021) discovered an optimal working capital level that successfully balances the trade-off between increasing sales and the costs related to customer financing. Zhou and Xu (2021) similarly illustrated that the correlation between working capital management and business profitability has a nonlinear pattern. Their research indicated that when the working capital cycle lengthens, profitability initially increases but ultimately decreases past a specific limit. They determined that an optimal amount of working capital exists, below which an increase in working capital boosts profitability, whilst over this threshold results in declining returns.

2.2.2 Supplier management

Supplier management, a fundamental aspect of corporate operations, is crucial for the implementation of daily activities and has thus garnered significant academic interest. Research in this domain predominantly centres on the following two facets:

1) *Supplier management research*: Johnsen et al. (2020) highlighted that with the continuous evolution of internet technologies, business supplier systems must also innovate to ensure the completeness of supplier management systems. Zhao et al. (2023) found that during times of crisis, digitalisation of the supply chain can reduce costs, enhance business performance and strengthen supply chain resilience for better outcomes. Sun et al. (2022) revealed that information delays and distortions within the supply chain are key factors contributing to excessive inventory accumulation. The introduction of blockchain technology has significantly enhanced the accuracy and speed of information exchange, leading to improved product and service quality. Wang et al. (2022) addressed the challenges faced by companies in managing supplier information by developing a response model using blockchain technology, which significantly improved the overall efficiency of supply chain management.

2) *A Study on the integration of supplier management and working capital*: Pirttila et al. (2020) investigated the influence of working capital management on financial performance in the Russian automobile sector. Their data indicate that timely and effective supplier payments correlate with increased profitability. This highlights the

essential importance of cultivating and sustaining positive relationships with suppliers to improve operational efficiency. Sundarakani et al. (2021) investigated the possibilities of digital transformation in supply chain management. They emphasised that utilising digital tools to enhance supply chain management enables organisations to attain substantial value creation while simultaneously decreasing working capital management expenses, thereby achieving dual advantages. Zhang et al. (2020) examined the relationship between supplier concentration and corporate cash retention strategies. Their research demonstrated that heightened supplier concentration correlates with an increase in corporate cash reserves, underscoring the necessity of judiciously determining supplier concentration levels to ensure financial stability. Lan (2021) offered a divergent viewpoint through her research on retail enterprises. She discovered a substantial positive correlation between supplier concentration and asset turnover in retail companies, providing valuable insights for optimising supply chain management strategies in the retail sector. Riofiandi and Tarigan (2022) shown that the execution of collaborative procedures among suppliers significantly impacts a company's overall performance.

2.2.3 Literature summary

A thorough academic investigation has been conducted on corporate working capital management, including topics such as drivers of working capital, evaluation criteria, the impact of working capital management on company performance and optimal working capital goals. These publications have created a solid theoretical foundation for more scholarly inquiry. The theoretical framework in supplier management has evolved, integrating supply chain management principles with working capital management methods, thereby improving working capital efficiency. However, little focus has been directed into the function of internal controls in the interplay between supply chain management and working capital management. This study aims to fill the research gap by examining whether internal control mechanisms operate as an effective moderating element in the link between supply chain management and the effectiveness of working capital management.

3 Theoretical framework and research hypotheses

3.1 Theoretical framework

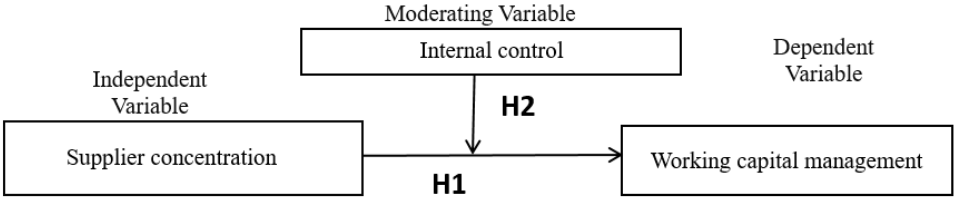
Suppliers, as one of the most important external stakeholders for a company, play a crucial role in business operations. Maintaining strong relationships with suppliers is essential, as it ensures access to high-quality raw materials and stable supply channels. Additionally, in times of cash flow challenges, a solid supplier relationship can secure credit sales, aiding the company in maintaining steady production. Stable supplier relationships enable companies to better respond to market changes and internal challenges, ensuring the continuity and reliability of production processes. From this perspective, a strong relationship with suppliers not only enhances supply efficiency but also optimises the turnover of operating capital. Such a collaborative relationship provides a robust foundation for the company's long-term stability and growth, enabling it to retain a competitive edge in a challenging market. Furthermore, effective

relationship management can create additional business opportunities, further driving the company's growth and prosperity.

Compared to internal managers, external suppliers are at a disadvantage in terms of information access. They can only assess the company's operational status through signals released by the company's management or by evaluating the quality of the company's internal controls. If a company has high-quality internal controls, suppliers are more confident in their collaboration with the company, leading to a closer partnership. This trust and stable collaboration benefit the company by not only enhancing its performance but also significantly improving the efficiency of operating capital turnover. Through robust internal controls, a company can convey reliable information, increasing the trust of external stakeholders and creating a mutually beneficial business environment. This positive cycle further promotes the firm's long-term development and reinforces its competitive advantage in the marketplace.

In accordance with the aforementioned theoretical justification, the conceptual framework of this research is constructed as seen in Figure 1.

Figure 1 Theoretical framework



3.2 Research hypotheses

At present, a substantial corpus of scholarship has been dedicated to examining the influence of supplier concentration on business enterprises. The term 'supplier concentration' is used to describe the proportion of a company's total procurement that is sourced from a relatively fixed number of suppliers (Zhang et al., 2020). The impact of supplier concentration on a firm's working capital management can be both beneficial and detrimental. On the positive side, stable supply channels can boost procurement efficiency, while having a concentrated supplier base can lower procurement costs, shorten inventory turnover periods and improve the overall efficiency of working capital management (Chang et al., 2016). Casalin et al. (2017) found through research that in China, as supplier concentration increases, companies significantly reduce inventory, improving the efficiency of working capital. Additionally, companies can establish close partnerships with suppliers to achieve resource sharing, thereby enabling suppliers to reduce order fulfilment times, minimise storage expenses and shift the responsibility for inventory management and ordering onto the suppliers (Southard and Swenseth, 2008).

Conversely, firms with significant supplier concentration face the task of manoeuvring within a more formidable negotiation environment. Suppliers may exert pressure on the organisation's profitability through price increases or reductions in material quality (Ak and Patatoukas, 2016). Powerful suppliers may even demand advance payments, leading to reduced internal cash flow, increased financial risk and hindrance to effective working capital management (Ahsan et al., 2022). Moreover, if the

supply chain relationship is disrupted, the company's invested specialised assets may lose value (Amoako-Gyampah et al., 2019), and the company may face procurement disruption risks due to the inability to promptly find new suppliers (Dhaliwal et al., 2016).

In summary, supplier concentration exerts a dual impact on a firm's working capital management. Considering the ever-changing business environment, suppliers should strengthen cooperation with companies to achieve mutual benefit, rather than using their advantage in the supply chain to squeeze downstream profits. In light of the aforementioned analysis, this paper puts forth the initial hypothesis:

Hypothesis 1: The higher the supplier concentration of a company, the higher the efficiency of its working capital management.

As one of the core external stakeholders of a company, suppliers are often at an informational disadvantage compared to the company's internal managers. The difficulty in gaining deep insight into the company's actual operations means that suppliers rely on information disclosed by the company's management and the robustness of its internal controls to assess the company's operational status. The more comprehensive a company's internal control system, the higher the level of trust suppliers will have in the company (Lin, 2014). A well-established internal control system can provide transparent, accurate and timely financial and operational information (Su, 2020), effectively mitigating information asymmetry and thereby boosting suppliers' confidence in the company. In this context, suppliers are more likely to offer more favourable credit terms, such as extended payment periods or additional trade credit. The establishment of a trust relationship has the potential to markedly improve the efficiency of a company's working capital management. This enables the company to allocate funds with greater flexibility and to mitigate short-term financial constraints.

When a company has a high supplier concentration, the completeness of its internal controls becomes even more crucial. High concentration means that the company engages in significant transactions with a few key suppliers who are heavily dependent on the company and, in turn, pay closer attention to its operational status. If the company can demonstrate an efficient and robust internal control system, these key suppliers will be more willing to offer better trade terms, further optimising the company's cash flow and management efficiency. Therefore, by enhancing information transparency and accuracy, reducing information asymmetry (Dai, 2020) and strengthening supplier trust, internal controls not only reduce supply chain risk but also enhance the company's reputation among suppliers, ultimately leading to optimised working capital management. Based on the preceding analysis, this paper presents the second hypothesis:

Hypothesis 2: The effectiveness of internal control positively moderates the relationship between supplier concentration and the efficiency of corporate working capital management.

4 Research design

4.1 Sample selection

This research employs a sample of A-share listed firms from the Shanghai and Shenzhen Stock Exchanges, spanning the years 2012 to 2019. The data set commences on 1 January 2012, following a reclassification of industry categories by the China Securities Regulatory Commission (CSRC) at that juncture. The data set was collected until 2019, as the global pandemic triggered by the 2019 novel coronavirus (SARS-CoV-2) had a significant impact on company operations, and data from 2020 onward is excluded to avoid this influence. In order to guarantee the veracity and consistency of financial data, it is essential to exclude observations that do not adhere to the established accounting standards. This ensures that the conclusions drawn are not influenced by the varying standards and practices employed by different entities. Additionally, observations related to financial companies, those designated for Special Treatment (ST) and those lacking crucial variables are excluded from the analysis. This process yielded a final sample size of 7451 observations.

4.2 Data sources

This research is solely based on secondary data. Specifically, data pertaining to firms' internal control is acquired from the DIB (Dibo) database, and additional pertinent financial and operational data is taken from the China Stock Market & Accounting Research (CSMAR) database.

The DIB database, created by Dibo Enterprise Risk Management Technology Co., Ltd., is the first specialist database in China focused on internal control and risk management. It is founded on the Audit Analytics Database and further enhanced by Dibo's extensive knowledge in internal control and risk evaluation. The DIB database is esteemed for its extensive coverage, superior data quality and distinctive analytical insights, and is highly regarded by academics and professionals as a trustworthy and authoritative resource in the field of internal control and risk management in China.

The CSMAR database, created by Shenzhen Xishima Data Technology Co., Ltd., is a specialised and accurate research tool intended for academic purposes. It incorporates esteemed sources such as CRSP, COMPUSTAT and TAO.THOMSON, while being specifically designed for China's economic and financial landscape. Chen and Xie (2019), Wang et al. (202), Li et al. (2022), Huang et al. (2023), Zhang et al. (2020), Wang and Ge (2023), Huang et al. (2022a, 2022b) and Guo and Xu (2021) validated the practicality and scientific integrity of utilising the CSMAR database for acquiring financial data of publicly traded firms in China. Currently, many universities in China have purchased access to these databases, which can be accessed through their respective library websites.

4.3 Research model and variable description

This study empirically examines the effect of supplier concentration on the efficiency of working capital management by constructing and employing Model 1 for analysis:

$$\mathrm{CCC}_{i,t} = \beta_0 + \beta_1 \mathrm{supplier}_{i,t} + \sum_j \beta_j Controls_{j,i,t} + \sum Industry + \sum Year + \varepsilon$$

This research used Model 2 to further validate the premise that internal controls affect the link between supplier concentration and the effectiveness of working capital management:

$$CCC_{i,t} = \delta_0 + \delta_1 \text{supplier}_{i,t} + \delta_2 Ice_{i,t} + \delta_3 \text{supplier}_{i,t} \times Ice_{i,t} + \sum_j \delta_j Controls_{j,i,t} + \sum Industry + \sum Year + \varepsilon$$

In the above models, this study used the Cash Conversion Cycle (CCC) as the primary indicator for evaluating the effectiveness of working capital management, referencing the research by Iqbal et al. (2020) and Mahmood et al. (2022). The CCC is calculated by summing Days Sales Outstanding (DSO) and Days Inventory Outstanding (DIO), and then subtracting Days Payable Outstanding (DPO), so reflecting the efficiency of working capital turnover. Supplier concentration is quantified by the percentage of the total yearly procurement expenditure attributed to the company's five largest suppliers, as cited by Zhang et al. (2020). For the internal control variable, denoted as Ice, this study uses the internal control index and applies its natural logarithm to quantify the level of internal control. This approach follows the methodologies used by Li et al. (2020) and Huang et al. (2022a).

This study considers other factors that may affect a company's efficiency in managing its working capital to assure the accuracy and robustness of the empirical results. The analysis accounts for the following factors as per the extant literature: Company Size: Larger companies often have stronger bargaining power and financial management capabilities, allowing for more effective working capital management (Zhang et al., 2020). Return on Assets (ROA): An elevated ROA indicates that the company utilises its assets more effectively to create profits, maintain consistent cash inflows, optimise inventory and accounts receivable management and facilitate short-term borrowing. This helps maintain a healthy working capital status (Wang and Ge, 2023). Growth Potential: Expanding enterprises may necessitate increased working capital to facilitate growth. Effective working capital management is crucial to avoid constraints due to insufficient funds (Anton and Nucu, 2020; Alshirah et al., 2022; Fernando et al., 2020). Additionally, following the approach of Jiang (2018), this study incorporates industry and year dummy variables to control for unobserved heterogeneity arising from sectoral differences and temporal fluctuations. This helps account for industry-specific and temporal variations that may affect the results.

Table 1 presents comprehensive definitions and elucidations of the variables

Table 1 Variable definitions and explanations

Nature of variables	*Variable names*	*Variable symbols*	*Variable measurement*
Dependent Variable	Efficiency of Working Capital Management	CCC	Cash Conversion Cycle (CCC) =Days sales outstanding + Days inventory outstanding – Days payable outstanding
Independent Variable	Supplier Concentration	Supplier	Total Procurement from Top 5 Suppliers/Total Annual Procurement
Moderating Variable	Effectiveness of Internal Control	Ice	Ln (Internal Control Index of Listed Companies)

Table 1 Variable definitions and explanations (continued)

Nature of variables	*Variable names*	*Variable symbols*	*Variable measurement*
Control Variables	Company size	Size	Ln (Average total assets)
	Debt-to-Asset Ratio	Lev	Liabilities / assets
	Return on Assets	Roa	EBIT/Average assets at the beginning and end of the year
	Growth potential	Growth	Revenue growth rate
	Industry	Industry	Dummy variable, indicating the industry to which the sample belongs
	Year	Year	Dummy variable, indicating the year to which the sample belongs

4.4 Descriptive statistics of related variables

Table 2 presents the descriptive statistics for the variables. According to the data in the table: Cash Conversion Cycle (CCC) has an average of 112.65 days, with a maximum value of 277.04 days and a minimum value of –94.07 days. This demonstrates large diversity in cash conversion cycles among different organisations, demonstrating major differences in working capital management efficiency. Supplier Concentration: The mean supplier concentration is 31.76%, with a minimum of 9.79% and a maximum of 89.19%. This indicates that certain organisations depend significantly on a small group of primary suppliers, with the top five suppliers representing about 90% of total procurement, and others have a more varied supplier network, with the top five contributing less than 10%. The statistics indicate significant disparity in supplier concentration among the sampled enterprises.

Table 2 Descriptive statistics of variables

Variable	*N*	*Min*	*Mean*	*Median*	*Max*	*SD*
CCC	7451	–94.07	112.65	98.26	277.04	76.21
Supplier（%）	7451	9.79	31.76	30.01	89.19	18.07
Size	7451	18.29	21.66	22.37	26.4	1.03
Growth	7451	–0.986	0.125	0.130	27.42	0.718
Lev	7451	0.008	0.351	0.360	0.985	0.180
Roe	7451	–1.207	0.084	0.0840	1.751	0.092
Ice	7451	1.792	3.556	3.594	3.947	0.185

4.5 Correlation analysis of key variables

Table 3 displays the results of the Pearson correlation analysis for the sample variables. The findings demonstrate a statistically significant inverse association between the Cash Conversion Cycle (CCC) and Supplier Concentration at the 5% significance threshold.

This indicates that companies with more supplier concentration often have shorter cash conversion cycles, signifying improved efficiency in working capital management. However, it is important to note that this represents a bivariate correlation and does not, in itself, provide sufficient evidence to confirm the hypotheses of this study. Accordingly, more robust empirical validation through regression analysis is conducted in the subsequent sections.

Table 3 Correlation coefficients of key variables

	CCC	*Supplier*	*Size*	*Growth*	*Lev*	*Roe*	*Ice*
Ccc	1						
Supplier	–0.01**	1					
Size	–0.19***	–0.23***	1				
Growth	0.03***	0.00	0.03**	1			
Lev	–0.11***	–0.14***	0.49***	0.07***	1		
Roe	–0.13***	–0.08***	0.15***	0.21***	–0.03**	1	
Ice	0.02***	–0.05***	0.08***	0.08***	0.01***	0.03***	1

Notes: The symbol '***' signifies a significance level of 1%, '**' indicates a significance level of 5% and '*' denotes a significance level of 10%. This notation will be uniformly applied in other tables as well.

5 Empirical results analysis

5.1 Testing the impact of supplier concentration on working capital management efficiency

Table 4 displays the results from four different regression models:

Column (1) presents the regression outcomes excluding control variables and corrections for year and industry fixed effects. The research indicates a statistically significant inverse association between the Cash Conversion Cycle (CCC) and supplier concentration at the 5% significance level. Column (2) incorporates control factors while excluding year and industry effects; in this specification, the negative correlation between CCC and supplier concentration intensifies, reaching significance at the 1% level. Column (3) controls for year and industry fixed effects while excluding other control variables; the negative correlation persists as statistically significant at the 10% level. Column (4) includes control variables and fixed effects for year and industry, with findings consistently indicating a substantial negative correlation between CCC and supplier concentration at the 5% significance level. Overall, the regression outcomes presented in Table 4 consistently indicate that higher supplier concentration is associated with shorter cash conversion cycles, reflecting enhanced efficiency in working capital management. These findings provide empirical support for Hypothesis 1.

Table 4 Regression results for supplier concentration and working capital management efficiency

Variables	*CCC*			
	(1)	*(2)*	*(3)*	*(4)*
Supplier	–0.105**	–0.152***	–0.099*	–0.105**
	(–2.18)	(–3.21)	(–1.80)	(–1.96)
Size		–6.451***		–5.484***
		(–6.44)		(–3.62)
Growth		13.662***		14.073***
		(17.73)		(17.62)
Lev		–8.600		0.444
		(–1.57)		(0.07)
Roe		–51.899***		–36.218***
		(–7.18)		(–4.70)
Constant	125.616***	272.796***	117.758***	235.237***
	(51.08)	(12.71)	(41.57)	(7.42)
Year	no	no	yes	yes
Industry	no	no	yes	yes
Observations	7451	7451	7451	7451
R^2-squared	0.234	0.427	0.583	0.586

This situation may be attributed to one or more of the following factors:

First, high supplier concentration means that a company procures a large volume of raw materials or goods from a few suppliers. In such cases, the company often establishes closer relationships with these suppliers, including better credit terms and more flexible delivery arrangements. This helps accelerate inventory turnover, reduce the capital tied up in inventory and thus shorten the cash conversion cycle. Second, conducting large-scale transactions with a few suppliers can reduce transaction costs related to sourcing, negotiating and contract management. This centralised purchasing strategy not only saves costs but also enhances supply chain management efficiency, further optimising the company's cash flow. Third, companies with high supplier concentration may find it easier to monitor and manage risks within their supply chain. Maintaining close relationships with a few key suppliers helps the company quickly respond to supply chain disruptions or fluctuations, thereby avoiding cash flow issues in production and sales due to supplier problems.

5.2 Testing the moderating effect of internal control

Table 5 presents the results of two regression models:

Column (1) displays the regression model using the internal control variable, while Column (2) features the interaction term between supplier concentration and internal control. The regression findings in both columns indicate a substantial negative association between the Cash Conversion Cycle (CCC) and supplier concentration. This suggests that increased supplier concentration correlates with a reduced cash conversion cycle, signifying improved efficiency in working capital management. In the regression

findings of Column (2), the interaction term between supplier concentration and internal control (Supplier*ICE) demonstrates a significant negative connection at the 5% significance level. This research indicates that the internal control mechanism favourably influences the relationship between supplier concentration and the efficiency of working capital management. Specifically, a robust internal control system may further optimise the collaboration between the company and its concentrated suppliers through more efficient supply chain management, risk management and financial oversight, thereby further shortening the cash conversion cycle. This result validates the second hypothesis that internal control can enhance the positive impact of supplier concentration on working capital management efficiency. With effective internal control, companies can better manage and utilise working capital even with high supplier concentration, achieving higher capital turnover efficiency.

Table 5 Regression results of the moderating effect

Variables	*CCC*	
	(1)	*(2)*
Supplier	–0.105**	–0.110**
	(–1.96)	(–2.06)
Size	–5.487***	–5.522***
	(–3.62)	(–3.65)
Growth	14.072***	14.078***
	(17.61)	(17.62)
Lev	0.439	0.508
	(0.07)	(0.08)
Roe	–36.217***	–36.126***
	(–4.69)	(–4.68)
Ice	–0.204	0.266
	(–0.06)	(0.08)
Supplier*Ice		–0.279**
		(–2.31)
Constant	236.003***	235.234***
	(6.90)	(6.88)
Year	yes	yes
Industry	yes	yes
Observations	7451	7451
R^2-squared	0.586	0.586

This situation may arise for the following reasons:

First, when a company's internal control is more robust, suppliers are more willing to establish long-term relationships with it. Effective internal controls not only enhance the supplier's trust in the company but may also lead to suppliers offering higher discounts and more favourable commercial credit terms. Second, close collaboration between the company and a few suppliers can reduce information asymmetry between the parties. The

company can more accurately forecast demand and supply changes in the supply chain, thus optimising the allocation of funds and effectively shortening the cash conversion cycle.

6 Research conclusions and future research directions

6.1 Research conclusions

In line with the principles of information asymmetry and stakeholder theory, this study utilises a panel data set comprising non-financial A-share listed firms in China from 2012 to 2019 to empirically examine the relationships among internal control, supplier concentration and the efficiency of working capital management. The results demonstrate that increased supplier concentration is substantially linked to a reduced cash conversion cycle, hence improving the efficiency of working capital management. This suggests that increased supplier concentration contributes positively to capital turnover and liquidity. Moreover, the moderating effect analysis demonstrates that internal control plays a significant reinforcing role in this relationship. Specifically, the presence of a robust internal control system amplifies the beneficial effect of supplier concentration on working capital efficiency. A sound internal control framework enhances supplier confidence, prompting suppliers to offer more favourable purchasing terms and extended trade credit. These advantages facilitate more rapid capital turnover and improve the efficiency of capital utilisation, ultimately contributing to better financial performance.

Based on the previously described research findings, this report offers the subsequent policy recommendations:

1) *Strengthen the internal control system*: Companies should focus on improving and optimising their internal control systems by implementing sound management policies and supervisory mechanisms to enhance internal control quality. High-quality internal controls not only build greater trust with suppliers but also play a positive role in supply chain management, thereby improving working capital management efficiency.

2) *Optimise supplier management strategies*: Companies should focus on establishing long-term relationships with core suppliers and increasing supplier concentration. When selecting suppliers, companies should prioritise forming partnerships with those that have a good reputation and stable cooperation. This approach leverages the advantages of supplier concentration, such as bargaining power and commercial credit, to shorten the cash conversion cycle and enhance capital utilisation efficiency.

6.2 Future research directions

This study employs a sample of non-financial A-share listed companies in China from 2012 to 2019. While this sample is representative to a certain extent, it does not include unlisted firms, which may operate under different resource constraints and governance environments in relation to supplier concentration and working capital management. As such, the external validity of the research findings is limited. Furthermore, the measurement of key variables in this study involves certain simplifications. Supplier concentration is proxied by the proportion of purchases from the top five suppliers, a

widely used indicator in existing literature. However, this metric does not capture micro-level characteristics such as the quality of supplier relationships, the distribution of bargaining power or the presence of long-term strategic partnerships. Similarly, the quality of internal control is measured using the DIB index, which may not fully reflect the actual implementation effectiveness or the nuanced differences across internal control systems.

Given these limitations, future research may consider the following two directions:

First, expanding the sample scope and contextual applicability. Future studies could extend the sample to include unlisted firms, thereby exploring the similarities and differences in the relationship between supplier concentration and working capital management under varying levels of corporate governance and financing constraints. Cross-country comparative studies may also be conducted to examine how institutional settings, supply chain cultures and financing environments influence the underlying mechanisms.

Second, incorporating multidimensional indicators and identifying structural characteristics. Future research could adopt more comprehensive measures of supplier concentration by integrating non-financial indicators such as supplier dependency, transaction frequency and contract duration, to provide a more accurate depiction of supplier relationship structures. Similarly, the measurement of internal control could be enhanced by incorporating indicators that reflect the quality of institutional design and the effectiveness of supervisory implementation, thereby improving the explanatory power of the research.

Declarations

All authors declare that they have no conflicts of interest.

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