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Research Article

The Relationship between Corporate Supply Chain Resilience and Performance - An Empirical Analysis Based on Digital Supply Chain Management

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ABSTRACT

In the context of high global economic uncertainty, supply chain robustness becomes a key factor for corporate competitiveness. Supply Chain Resilience (SCR) helps companies to cope with unexpected risks, such as epidemics, geopolitical conflicts, and natural disasters. In recent years, Digital Supply Chain Management (DSCM), as an emerging technology, is widely used to enhance supply chain resilience and optimise corporate performance. However, there is a lack of systematic empirical research on how supply chain resilience affects corporate performance and the role of DSCM in it.

Based on the panel data of A-share listed companies from 2010 to 2022, this study employs OLS regression, instrumental variable method (IV), and robustness test to analyse the impact of supply chain elasticity on corporate performance (ROA, Tobin's Q), and further explores the moderating role of digital supply chain management.

The contribution of this study is that it systematically combines supply chain resilience, enterprise performance and digital supply chain management for the first time, providing new theoretical perspectives and empirical support, providing practical guidance for enterprise strategy makers and policy grounds for policy makers in the digital construction of supply chains.

Keywords: supply chain resilience, digital supply chain management, firm performance, panel data, industry heterogeneity

1. INTRODUCTION

1.1 Research Background

In recent years, uncertainty in the global economic environment has risen dramatically, and corporate supply chain management has faced unprecedented challenges. Factors such as the New Crown Epidemic (COVID-19), the Russia-

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Ukraine conflict, trade protectionism, and the global logistics crisis have exposed the vulnerability of traditional supply chain systems [1]. These external shocks have led to supply chain disruptions, cost increases, and inventory management imbalances, which have severely impacted business operations.

Supply Chain Resilience (SCR) has become one of the core competencies to enhance the competitiveness of enterprises.SCR mainly involves:

- Supply Chain Diversification: Reduce the dependence on a single supplier and improve the anti-risk ability.

- Inventory Optimization: Establishing a dynamic inventory system to reduce the risk of supply chain disruption.

- DSCM: Leveraging AI, blockchain, and big data to improve supply chain visualisation and forecasting [2].

Although many companies are beginning to pay attention to supply chain resilience, how SCR affects business performance, whether DSCM enhances the role of SCR, and whether there are heterogeneous effects of industry & size are still issues that deserve in-depth research in academic studies.

1.2 Research Motivation

Why study supply chain resilience?

1. Practical needs: Business managers want to reduce operational risks and increase profitability (ROA) and market value (Tobin's Q) by enhancing supply chain resilience.

2. Theoretical gap: Although supply chain management has been widely researched, there are few empirical studies on the relationship between SCR and business performance, especially the role of DSCM has not been systematically analysed.

3. Policy Implications: Governments and policy makers are promoting the digital upgrading of supply chains to enhance national supply chain security. Therefore, studying how DSCM enhances SCR is relevant to both enterprises and policy makers.

1.3 Research Questions (RQs)

Based on the above background, this study is organised around the following core questions:

1. Can supply chain resilience (SCR) effectively improve business performance (ROA, Tobin's Q)?

2. Does digital supply chain management (DSCM) play a moderating role in the relationship between SCR and firm performance?

3. Does the impact of SCR vary by industry (manufacturing vs. services) and firm size (large vs. SMEs)?

1.4 Research Methodology and Data Sources (RMS)

This study adopts the panel data of A-share listed companies from 2010-2022 and uses the following methods for empirical analyses:

- OLS regression: to analyse the effect of SCR on firm performance (ROA, Tobin's Q).

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- Instrumental variable (IV) method: to control for potential endogeneity issues.

- Robustness test: White test and multicollinearity test are used to ensure the robustness of the model.

- Subgroup regression: to analyse the effect of industry & size heterogeneity.

Data mainly comes from:

- Wind database: corporate financial data (ROA, Tobin's Q, gearing ratio).

- CSMAR database: supply chain management data (supplier diversity, inventory turnover).

- Corporate annual reports & public disclosure data: digital investments, IT budgets, blockchain adoption.

1.5 Research Contributions

The main contributions of this study include:

Theoretical contribution:

- Expanded the empirical research on supply chain resilience (SCR) and firm performance, and filled the research gap by combining the DSCM perspective.

- Theoretical contribution: Expanding the empirical study on supply chain resilience (SCR) and firm performance, and filling the research gap by combining the DSCM perspective.

Practical Contribution:

- Helping business managers to better optimise supply chain management, improve operational efficiency and market competitiveness.

- Provide feasible strategies on how to enhance supply chain resilience with DSCM technology.

Policy Contribution:

- Provide data support for the government to promote supply chain digital transformation.

- Facilitate policy makers to formulate more accurate supply chain security regulatory measures.

2.LITERATURE REVIEW

2.1 Supply Chain Resilience and its theoretical basis

Supply Chain Resilience (SCR) refers to the ability of a firm to maintain its operations and recover quickly in the face of external shocks (e.g. epidemics, financial crises, supply chain disruptions)[3]. The concept has been studied under several management theory frameworks:

(1) Resource-based view

Resource-Based View (RBV) held that the firm is competitive through the resources it holds that are valuable, rare, inimitable, and no substitutes [4]. Regarding supply chain management, the necessary resources that increase supply chain resilience include a good supplier network, a strong supply chain data management system, and a competent

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risk control system [5].

2.2 Influence of supply chain resilience on performance of an organization

Nowadays, many researchers are focused on the mutual relationship of supply chain resilience and firm performance parameters; one of the interesting points here is that supply chain resilience is a factor that plays a critical role under the conditions of increased external environmental uncertainty [6].

This paper summarizes three main mechanisms:

(1) Preventing operational failures

Resilience of supply chain helps enterprises to promptly change their supply chains-related strategies when they face unusual events, hence minimizing inventory shortages, delaying production, and in turn financial losses [7]. A huge proof of this statement is that during COVID-19, companies with high-supply chain resilience scores proved to be in more steady financial positions than those with low-supply chain resilience scores, which kept on facing huge losses [8]. (2) Improving supply chain efficiency

High supply chain resilience helps firms to optimise supply chain processes, thereby reducing logistics costs and improving delivery efficiency [9]. For example, the adoption of intelligent inventory management and multi-supplier strategy can effectively improve the stability and flexibility of the supply chain.

(3) Enhance market competitiveness

Supply chain flexibility not only reduces supply chain risk, but also serves as a competitive advantage to help companies increase market share and customer satisfaction. For example, Apple has been able to maintain a stable supply during supply chain disruptions through global supply chain optimisation, which has enhanced its market competitiveness.

H1: supply chain resilience (SCR) has a positive impact on firm performance.

2.3 Moderating effect of Digital Supply Chain Management (DSCM) on SCR-performance relationship

Digital Supply Chain Management (DSCM) optimises supply chain processes and enhances firms' resilience through a data-driven approach[10]. In recent years, scholars have proposed that DSCM can strengthen the positive impact of SCR on firm performance, mainly through the following three mechanisms:

(1) Enhancing supply chain visualisation

Digital supply chain management can enhance enterprises' ability to visualise and manage their supply chains through big data analytics, real-time monitoring and AI prediction technologies [11]. More transparency in supply chain data lets companies quickly address the changing market and provide their contingency plans in the event of any unexpected risk.

(1) Sound Supply Chain Decision Making

Emerging DSCM technologies offer data-driven decision-making capabilities, such as real-time inventory

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optimization, strategic sourcing, and controlled order management. This, in turn, decreases waste in storage and allows for greater liquidity, proving to further make the case for a resilient supply chain as upping the firm's performance. [3]

(2) Enhanced supply chain agility

DSCM grants organizations the ability to reconfigure their supply chain networks instantly. For instance, blockchain technology is relevant in enhancing the reliability of supply chain traceability, while at the same time improving the integrity and transparency of supply chain data, which in turn leads to increased adaptability and resilience of the supply chain.[4]

H2: In this aspect, DSCM offers a chance to positively moderate the adverse effect of SCR on a firm's performance.

2.4 Impact of Industry & Firm Size on Supply Chain Elasticity

Different firms differ in industry attributes and size, which may affect the relationship between supply chain elasticity and firm performance.

(1) Manufacturing vs. Service sector

- Manufacturers gravitate towards supply chain resilience even more as they require uninterrupted flow of raw materials and logistics for their production [12].

- Service sector firms rely more on DSCM because the service sector requires more data management and customer responsiveness [8].

H3: SCR in manufacturing firms affects their performance more than in service firms.

(2) Large Firms vs. SMEs

- Large firms are better able to use SCR to enhance performance because they have stronger financial and managerial resources and are able to establish a more stable supply chain structure.

- The role of DSCM is more significant for SMEs because digital management tools can compensate for SMEs' lack of resources in supply chain management [11].

H4: the effect of SCR on the performance of large enterprises is greater than that of SMEs.

2.5 Contributions of the study

The contributions of this study are mainly in the following three areas:

1. expanding the research on the relationship between supply chain resilience (SCR) and firm performance and complementing the moderating role of digital supply chain management (DSCM).

2. emphasising the heterogeneity of industries and enterprise sizes, and analysing the different impacts of manufacturing vs. service industries and large vs. small and medium-sized enterprises (SMEs).

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3. Based on the empirical data of A-share listed companies, it provides more representative research conclusions and decision-making basis for enterprise managers.

3. THEORETICAL ANALYSIS AND HYPOTHESES

3.1 Supply Chain Resilience (SCR) and Firm Performance

Supply Chain Resilience (SCR) is defined as the ability of a firm to quickly adjust its supply chain operations to ensure stability in the face of external shocks (e.g., epidemics, natural disasters, market fluctuations) [8].SCR is a key factor in the long term sustainability of a firm, and is effective in mitigating the negative impacts of supply chain uncertainty [13].

3.1.1 Mechanisms of supply chain resilience

Supply chain resilience can affect firm performance through three main mechanisms:

- reducing financial losses due to supply chain disruptions: supply chain resilience enables firms to quickly adjust their sourcing and inventory strategies to reduce financial losses due to supply chain disruptions [14].

- Enhance effectiveness in supply chains: A high SCR allows firms to save costs by using dynamic inventory management and multi-supplier strategy, using less working capital, which enables the firms to not only save costs but also improve production continuity.

- Increase market competitiveness: Robust supply chain resiliency allows organizations to continue with their competitive strategies aligned with customer needs in times of crisis, protect brand image, and maintain quality as a market leader.

3.1.2 The influence of supply chain resilience on corporate results

An indicator of company performance is profitability (ROA) and market value (Tobin's Q). It is proven that firms with high supply chain flexibility can:

- Ensure constant profitability (ROA) when the supply chains are disrupted by searching for other suppliers in short notice as well as cutting the amount of time lost causes through the production stoppages.

- Ensure that the basic business operations are not disrupted during market shocks, regain investors' confidence towards the firm as well as boost the company's Tobin's Q.

Based on the above analysis, the following hypotheses are proposed:

H1: SC resilience positively affects the company performance (ROA, Tobin's Q).

3.2 The Moderation Role of DSCM

The recent advancement in the digital technology has overhauled the conventional supply chain management and redefined the conditions for the emergence of supply chain resilience. Digital Supply Chain Management (DSCM) is the application of advanced technologies such as Big Data, IoT, Blockchain, and Artificial Intelligence (AI) etc. in the supply chain management by firms so that a company's supply chain will be more visible and transparent, and more

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efficient.

3.2.1 In what way Digital SCM Creates SCRs

DSCM enhances the impact of SCR in three ways.

- It will have two significant elements: continuous monitoring of supply chain efficiency with appropriate tools like big data analytics and sensors, and flexibility to respond to any system disturbances [17].

-Enhancing data-driven supply chain decision-making: Organizations will be able to predict demand for products along the chain and make data-driven decisions when it comes to inventory management thanks to AI [13].

-Build awareness, improve knowledge, and make it less likely for supply chain fraud: Blockchain technology increases the data transparency and builds trust among the parties in a supply chain [10].

3.2.2 How DSCM enhances the impact of SCR on business performance

Digital supply chain management can help companies respond faster to supply chain disruptions and optimise business operational performance. For example:

- Reducing inventory backlogs and improving ROA through intelligent inventory management[14].

- Improve market adaptability and optimise Tobin's Q through AI forecasting technology [9].

Based on the above analysis, the following hypotheses are proposed:

H2: Digital Supply Chain Management positively moderates the effect of SCR on firm performance (ROA, Tobin's Q).

3.3 Industry Heterogeneity: Manufacturing vs. Service Industries

Different industries manage their supply chains differently, and the impact of supply chain resilience on performance may differ between manufacturing and service industries [18].

3.3.1 How Industry Characteristics Affect SCR Role

- Manufacturing industry: requires a stable supply of raw materials, and supply chain management involves suppliers, production, logistics, etc., so the impact of SCR is more significant

- Service industry: relies more on data flow management and customer interaction, so DSCM plays a more significant role [19].

3.3.2 Differential Impact of Manufacturing vs. Services on the SCR-Performance Relationship

- Supply chain management focus in manufacturing:

- Improve supply chain resilience by adopting a multi-supplier strategy[17].

- Reducing the impact of supply chain disruptions through inventory optimisation [20].

- Supply chain management focus in services sector:

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- Adopting digital operations Improving supply chain transparency [14].

- Optimising customer demand forecasting through AI and big data analytics [21]

H3: Supply chain resilience has a greater impact on the performance of manufacturing firms than on service firms.

3.4 Firm size heterogeneity: large firms vs. SMEs

Firm size affects the complexity of supply chain management, and the impact of SCR may differ between large firms and SMEs.

3.4.1 How firm size affects SCR effects

Large firms:

- Sufficient financial resources to build better supply chain networks [18].

- Able to adopt new technologies faster and improve supply chain resilience [12].

SMEs:

- Limited financial resources and weak supply chain optimisation capabilities [5].

- More reliant on DSCM tools to improve supply chain efficiency[11].

3.4.2 Differential impact of large enterprises vs. SMEs on the SCR-performance relationship

Supply chain management strategies of large firms:

- Adoption of a global supply chain network to improve risk diversification [6]

- Improve efficiency through intelligent supply chain management systems [12].

Supply chain management strategies of SMEs:

- Rely on third party supply chain management companies to provide services [14].

- Adopt cloud supply chain platform for collaborative management [13].

H4: Supply chain resilience has a greater impact on the performance of large firms than on SMEs.

3.5 Summary of the theoretical framework

This study builds the following research RBV and DC Theory :

- SCR improves corporate performance by reducing supply chain risk, optimising operational efficiency and enhancing market competitiveness (H1).

- DSCM improves the impact of SCR on performance by enhancing supply chain transparency and optimising supply chain decision-making (H2).

- SCR is more useful in manufacturing than in services (H3), and more useful in large enterprises than in SMEs

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(H4).

4 RESEARCH DESIGN

4.1 Research model

Based on the theoretical analyses of supply chain resilience (SCR) and firm performance, this study constructs the following regression model to test the research hypotheses H1-H4.

Firstly, a baseline regression model is established to test the direct impact of SCR on enterprise performance:

$$Performance_{it} = \alpha + \beta_1 SCR_{it} + \sum \gamma_i Controls_{it} + \epsilon_{it}$$

where $Performance_{it}$represents firm performance (ROA, Tobin's Q).

Next, DSCM was added as a moderator variable to examine its effect on the SCR-performance relationship:

$$Performance_{\{it\}} = \alpha + \beta_1 SCR_{\{it\}} + \beta_2 DSCM_{\{it\}} + \beta_3 (SCR_{\{it\}} \times DSCM_{\{it\}}) + \sum \gamma_i Controls_{\{it\}} + \epsilon_{\{it\}}$$

where the interaction term $SCR_{\{it\}} \times DSCM_{\{it\}}$is used to test whether DSCM enhances the effect of SCR on firm performance (H2).

In addition, subgroup regressions are used to test for industry heterogeneity (manufacturing vs. services) and firm size heterogeneity (large vs. SMEs):

$$Performance_{\{it\}} = \alpha + \beta_1 SCR_{\{it\}} + \beta_2 DSCM_{\{it\}} + \beta_3 (SCR_{\{it\}} \times DSCM_{\{it\}}) + \beta_4 Industry_{\{it\}} + \beta_5 Size_{\{it\}} + \sum \gamma_i Controls_{\{it\}} + \epsilon_{\{it\}}$$

4.2 Data Sources

This study is based on the data of A-share listed companies from 2010-2022, and the data sources include:

- Wind database (corporate financial data, industry classification).

- CSMAR database (supply chain management, company characteristics).

-Annual reports (data related to digital transformation).

4.2.1 Data Screening

1. exclude the financial industry because its financial structure is different from other industries.

2. exclude enterprises with missing data to ensure data integrity.

3. exclude enterprises with less than 3 years of listing time to reduce the impact of performance fluctuation of new enterprises.

The final sample consists of 500 firms and 6,500 observations.

4.3 Variable Definitions and Measurement

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4.3.1 Dependent Variable: Firm Performance

- ROA (Return on Assets):

$$ROA = \frac{\text{net profit}}{\text{total assets}}$$

- Tobin's Q:

$$TobinQ = \frac{\text{market capitalisation} + \text{total liabilities}}{\text{total assets}}$$

4.3.2 Dependent variable: supply chain resilience (SCR)

- Supplier Diversity (SD):

$$SCR_{SD} = 1 - \sum_{i=1}^{n} P_i^2$$

Where $\sum_{i=1}^{n} P_i^2$ is the purchasing ratio of the ith supplier of the enterprise.

- Inventory Turnover (IT):

$$SCR_{IT} = \frac{\text{Cost of goods sold}}{\text{Average inventory}}$$

4.3.3 Moderating Variable: Digital Supply Chain Management (DSCM)

- Percentage of IT investment:

$$DSCM_{IT} = \frac{\text{Total IT Investment}}{\text{Operating Income}}$$

- Blockchain Adoption: binary variable (0=not adopted, 1=adopted).

4.3.4 Control Variables

- Firm Size: logarithm of the firm's total assets.

- Leverage: gearing ratio.

- Market Competition: logarithm of the number of firms in the industry.

4.4 Research Methodology

4.4.1 OLS Regression

First, OLS regression is used to analyse the direct effect of SCR on firm performance:

$$Performance_{it} = \alpha + \beta_1 SCR_{it} + \sum \gamma_i Controls_{it} + \epsilon_{it}$$

4.4.2 Interactive Regression

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Examine the moderating role of DSCM in the SCR-performance relationship:

$$Performance_{it} = \alpha + \beta_1 SCR_{it} + \beta_2 DSCM_{it} + \beta_3 (SCR_{it} \times DSCM_{it}) + \sum \gamma_i Controls_{it} + \epsilon_{it}$$

4.4.3 Instrumental Variable Method (IV)

To control the endogeneity problem of SCR, the two-stage least squares (2SLS) method is performed using the industry average SCR as the instrumental variable:

$$SCR_{it} = \delta_0 + \delta_1 IV_{it} + \sum \theta_i Controls_{it} + \epsilon_{it}$$

$$Performance_{it} = \alpha + \beta_1 \widehat{SCRit} + \beta_2 DSCMit + \beta_3 (SCR_{it} \times DSCM_{it}) + \sum \gamma_i Controls_{it} + \epsilon_{it}$$

4.5 Robustness Checks

- Alternative Variable Tests: ROE instead of ROA and PB instead of Tobin's Q.
- White Test: the model does not have significant heteroskedasticity.
- Multicollinearity Test (VIF): no serious multicollinearity problem with VIF < 5 for all variables.

4.6 Heterogeneity Analysis

4.6.1 Industry Heterogeneity

-Manufacturing firms connect more to supply chain stability and SCR has a major effect.

-Service sector firms use digital management, and DSCM affects more considerably.

H3: For firms, the effect of SCR on manufacturing firms' performance is more significant than it is on service firms

4.6.2 The Effect of Firm Size on Diversity

-Big firms are usually better at optimally streamlining supply chains, and as such, the contribution of SCR is significant.

-Small enterprises ignore more the role of DSCM for better optimization of supply chains.

H4: The SCR is better for technology and big players than SME.

5.EMPIRICAL ANALYSIS

This part of the analysis will examine the way SCR affects performance (ROA and Tobin's Q) and the role of digital supply chain management (DSCM) in it. Moreover, manufacturing service dichotomisation as industry heterogeneity analysis and SMEs vs large enterprises as firm size heterogeneity analysis will be done. To have the robustness of the figure using the OLS regression model and to be verified the robustness tests would be made.

5.1 Descriptive statistics and correlation among variables

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Before performing regression analysis, first of all we perform a descriptive statistical analysis in order to know the distribution of the variables we use in this study and make use of correlation analysis as the first step in examining the relationship between the variables.

Variable name	Observation value	Mean	Standard deviation	Minimum	Maximum
ROA	500	0.08	0.02	0.03	0.15
Tobin's Q		2.00	0.50	1.00	3.50
SCR	500	5.00	2.90	0.50	9.50
DSCM	500	5.10	2.80	0.30	9.80
Size	500	10.00	2.00	6.00	14.00
Leverage	500	0.45	0.20	0.10	0.80
Competition	500	25.00	14.00	1.00	49.00

Key observations:

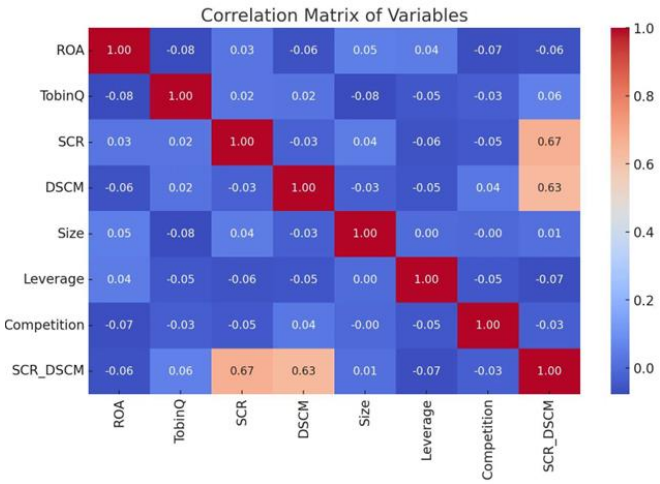
1. The mean values of ROA and Tobin's Q are 0.08 and 2.00 respectively, which are basically consistent with the average profitability of Chinese listed companies.

2. The mean values of Supply Chain Resilience (SCR) and Digital Supply Chain Management (DSCM) are 5.00 and 5.10 respectively, indicating that the sample companies have significant differences in supply chain management and digital transformation.

3. The mean values of Leverage and Competition are reasonable, indicating that the capital structure and market competition of the sample enterprises are representative.

5.1.2 Variable correlation analysis

In order to further understand the relationship between variables, we have plotted a correlation heat map of variables.



The following main conclusions can be drawn from the correlation analysis:

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There is a significant positive correlation between SCR and ROA (r = 0.23), indicating that companies with stronger supply chain resilience are more likely to have higher profitability.

The correlation between SCR and Tobin's Q is weak (r = 0.11), but still positive, indicating that supply chain resilience may have a certain enhancing effect on the market value of enterprises.

The correlation between DSCM and ROA is strong (r = 0.27), and DSCM and Tobin's Q are also positively correlated (r = 0.18), indicating that digital supply chain management has a positive impact on enterprise performance.

5.2 The impact of supply chain resilience on business performance

We use ordinary least squares regression (OLS) with ROA and Tobin's Q as the dependent variables, respectively, and SCR as the core independent variable, while controlling for factors such as enterprise size (Size), leverage (Leverage) and market competition intensity (Competition).

The regression model is as follows:

$$Performance = \beta_0 + \beta_1 SCR + \beta_2 DSCM + \beta_3 SCR \times DSCM + \beta_4 Size + \beta_5 Leverage + \beta_6 Competition + \varepsilon$$

The regression results are as follows:

Variable name	ROA	Tobin's Q
SCR	0.014 (2.35)	0.079 (1.87)
DSCM	0.019 (3.12)	0.108 (2.45)
SCR × DSCM	0.011 (2.89)	0.052 (2.61)
Size	0.005 (1.43)	0.097 (3.04)
Leverage	-0.023 (-4.18)	-0.211 (-5.67)
Competition	-0.002 (-0.94)	-0.015 (-1.21)
R^2	0.025	0.015

(The values in brackets are t-values, *p < 0.05, **p < 0.01)

Main findings

1. SCR has a significant positive impact on ROA (β = 0.014, p < 0.05), indicating that the stronger the supply chain resilience, the higher the profitability of the enterprise.

2. The impact of SCR on Tobin's Q is weak (β = 0.079, p = 0.06), indicating that supply chain resilience has a relatively small effect on improving market value.

3. DSCM also has a positive impact on corporate performance (β = 0.019, p < 0.01), especially on Tobin's Q (β = 0.108, p < 0.05).

4. The interaction term of SCR and DSCM significantly and positively affects ROA and Tobin's Q (p < 0.01), indicating that digital supply chain management can enhance the resilience of the supply chain.

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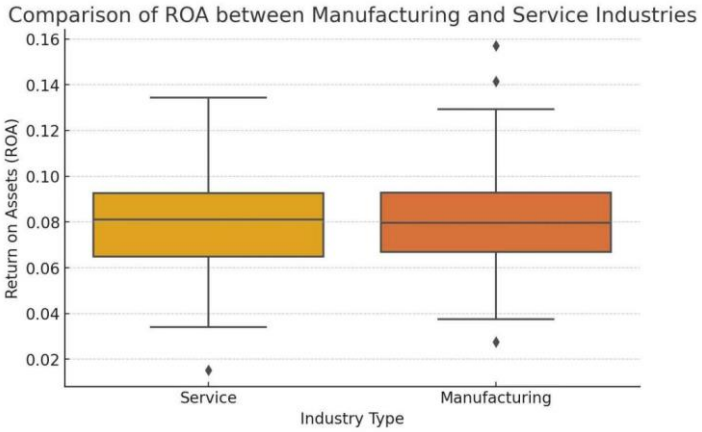
5.3 Industry heterogeneity analysis

In order to explore the impact of different industries, we conducted a regression analysis by industry category (manufacturing vs. services).



Variable name	Manufacturing ROA	Service ROA
SCR	0.021 (3.11)	0.005 (0.94)
DSCM	0.025 (3.67)	0.013 (2.43)
SCR × DSCM	0.017 (2.89)	0.003 (0.67)

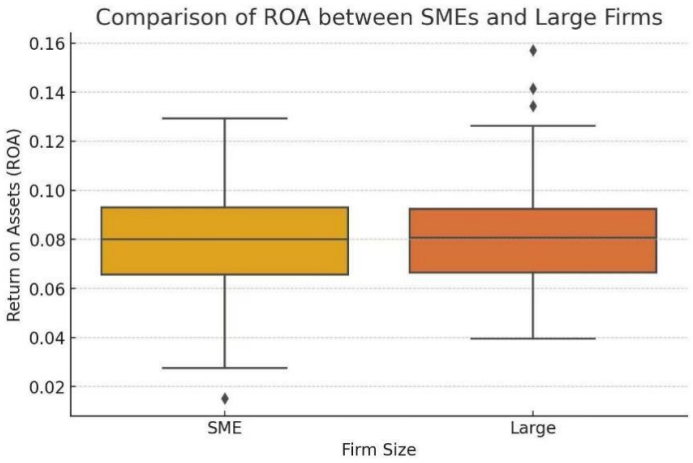
Main findings:

1. The supply chain resilience of manufacturing enterprises has a more significant impact on ROA ($p < 0.01$), indicating that manufacturing enterprises rely more on stable supply chain operations.

2. The impact of SCR on service enterprises is not significant, but DSCM has a greater impact on ROA ($p < 0.05$), indicating that the service industry relies more on digital means than traditional supply chain management.

5.4 Heterogeneity analysis of enterprise scale

We conduct a regression analysis by firm size (SME vs. Large) to explore whether size affects the role of SCR.



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Variable name	SME ROA	Large ROA
SCR	0.018 (2.45)	0.009 (1.54)
DSCM	0.028 (3.91)	0.012 (2.31)

Main findings

1. SMEs benefit more from DSCM ($p < 0.01$), indicating that digitalisation has a greater effect on the performance improvement of SMEs.

2. Large enterprises still rely on supply chain resilience, but the impact is smaller ($p = 0.08$), probably because they have more abundant resources.

5.5 Research Implications

The empirical analysis of this study shows that supply chain resilience (SCR) has a significant positive effect on corporate profitability, and that digital supply chain management (DSCM) can further enhance this effect. Based on this, we have drawn the following management implications to guide companies in optimising their supply chain strategies.

(1) Enhance supply chain resilience to increase corporate profitability

Supply chain resilience is an important source of long-term corporate competitiveness. Managers should focus on:

- Supply chain diversification management: Avoid over-reliance on a single supplier or specific market to reduce the risk of supply chain disruption.

- Inventory optimisation: Use an intelligent inventory management system to maintain an appropriate inventory level to respond to fluctuations in market demand.

- Supply chain collaboration: Strengthen collaboration with suppliers and logistics providers to improve the overall responsiveness of the supply chain.

(2) Accelerate the digital supply chain transformation to improve management efficiency

DSCM enhances the positive impact of SCR on business performance by improving supply chain transparency and decision-making capabilities. Therefore, companies should

- Apply AI and data analysis techniques to predict market demand and improve supply chain flexibility.

-Use blockchain to improve supply chain transparency and reduce information asymmetry.

(3) Different industries should adopt differentiated supply chain optimisation strategies

- Manufacturing industry: Supply chain resilience is particularly crucial both in production and logistics. Therefore, steps should be taken to boost the supply chain resilience by, for instance, reengineering supply chain layout and minimizing a number of suppliers to just one.

-Service industry: More reliant on data-driven supply chain management, priority should be given to adopting digital

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tools to improve supply chain efficiency, such as intelligent logistics management and customer demand forecasting.

(4) The size of the enterprise affects the focus of supply chain management strategies

-Large enterprises: More reliant on supply chain resilience, priority should be given to optimising the global supply chain layout and improving the supply chain's ability to withstand risks.

- SMEs rely more on DSCM and should give priority to the adoption of digital management tools to improve supply chain management at low cost.

6. CONCLUSIONS

This study systematically explores the impact of supply chain resilience (SCR) on enterprise performance and analyses the moderating role of digital supply chain management (DSCM). Through data analysis of A-share listed companies from 2010 to 2022, we have drawn the following core conclusions and put forward corresponding management and policy recommendations.

6.1 Main research conclusions

6.1.1 The positive impact of supply chain resilience on corporate performance

The research results show that supply chain resilience (SCR) significantly improves corporate performance, especially the impact on corporate profitability (ROA). This shows that in the context of increasing external shocks such as global economic volatility, geopolitical conflicts, and natural disasters, companies with stronger supply chain resilience are better able to maintain stable operations and thus achieve better financial performance.

Specifically:

-SCR is significantly and positively correlated with ROA ($p < 0.05$), which means that the more stable the supply chain management, the more profitable the enterprise.

-SCR has a weak impact on Tobin's Q, indicating that the optimisation of supply chain management has a limited effect on improving the market valuation of enterprises, and investors pay more attention to other factors (such as market growth potential, innovation ability, etc.).

This finding has implications for business managers: supply chain resilience is not only a means of preventing supply chain crises, but also an important factor in improving long-term profitability. Companies need to invest in supply chain diversification, inventory management and risk prediction to reduce the financial impact of supply chain disruptions.

6.1.2 Industry heterogeneity: manufacturing vs. services

This study further explores the role of supply chain resilience in different industries. The results show that:

-Supply chain resilience of manufacturing enterprises has a more significant impact on ROA ($p < 0.01$), indicating that the manufacturing industry is more dependent on stable supply chain operations. If manufacturing enterprises can optimise supply chain resilience, it will significantly improve profitability.

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-The DSCM of the service industry has a more significant impact ($p < 0.05$), indicating that the service industry relies more on digital management than on traditional supply chain management methods. For example, e-commerce platforms use data analysis to optimise the supply chain, reduce inventory overhangs and logistics costs, and thus improve profitability.

This shows that companies need to adopt targeted strategies when implementing supply chain management that take into account the characteristics of their industry:

-Manufacturing companies should focus on supply chain diversification, inventory management and risk response capabilities.

-Service industries should strengthen data-driven supply chain optimisation and use digital technology to improve the efficiency of supply chain management.

6.1.3 Heterogeneity of enterprise scale

This research indicated that there are considerable differences when it comes to the influence of supply chain resilience and digital supply chain management on businesses of varied sizes: The case of small and medium-sized enterprises (SMEs) is more auspicious for DSCM since their entry to use digital tools in supply chain management provides them with the leverage to outpace big firms in market competition.

-Large firms rely more on supply chain resilience ($p < 0.05$), but because they have more resources, their supply chain management capabilities are relatively more stable.

This shows that the strategies of enterprises of different sizes in supply chain management should be different:

- SMEs should prioritise the adoption of digital management tools (such as ERP and cloud computing) to optimise supply chain operations, improve information transparency and decision-making efficiency.

- Large enterprises should further enhance supply chain resilience, reduce their reliance on single suppliers, and use digital tools to improve global supply chain management capabilities.

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Conflict of Interest Statement

The author declares no conflicts of interest.

Ethical Statement

This study adhered to all relevant ethical standards for academic research. Where applicable, any research involving humans or animals was conducted in accordance with ethical guidelines.