MODERATING ROLE OF FINANCING CONSTRAINTS ON THE INFLUENCE OF SUPPLY CHAIN CONCENTRATION AND STRATEGIC DEVIATION ON FIRM PERFORMANCE THROUGH TRADE CREDIT FINANCING: EVIDENCE FROM CHINESE LISTED MANUFACTURING COMPANIES

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Program	Business Administration
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ABSTRACT

This research aims to investigate: 1) the mediating role of trade credit financing between supply chain concentration and strategic deviation on firm performance and 2) the moderating role performed by financing constraints, including the moderated mediation effects.

The samples consisted of 1,357 manufacturing companies listed on the Chinese stock exchange from 2016 to 2021, resulting in a total of 7,488 firm-year observations. The data were collected from the Chinese CSMAR database and the annual financial reports. The statistical methodologies employed for analysis consist of descriptive statistics, univariate analysis, and multivariate regression analysis at a statistical significance level of .05.

The research results revealed that: 1) the supplier concentration affects firm operating performance (gross profit margin: GPM) through trade credit financing from suppliers, 2) the customer concentration affects firm financial performance (return on assets: ROA) through trade credit financing from customers, and 3) the strategic deviation impacts firm financial performance (ROA) through trade credit financing from suppliers. Moreover, the study revealed the moderating effect of financing constraints on the relationship between customer concentration and trade credit financing, as well as its moderated mediation on trade credit financing.

Keywords: supply chain concentration, strategic deviation, trade credit financing, financing constraints, firm performance

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Meng Qiang

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CHAPTER 1
INTRODUCTION

1.1 Background and Statement of the Problems

Strengthening supply chain relationship management has emerged as an essential aggressive method for organizations to enhance competitiveness, in the context of financial globalization and the speedy improvement of modern information technology (Cao ＆Zhang, 2011; Chang et al.,2016; Ataseven & Nair, 2017). Eighty percent of the world's top 500 companies have made supply chain management strategies (Feng & Wei, 2019). For example, Foxconn, a top 500 global company, maintains a high level of customer concentration, with 70% of its revenue coming from the top 5 customers. Midea Group works with extra than 100,000 aspect producers worldwide, and the pinnacle 5 suppliers have a buying share of round 5%. It has maintained its product vitality and market share via provider relationship management, and its merchandise will have a market share of extra than 30% in China through 2021. This suggests that a company's supply chain relationship management strategy is intently linked to its competitiveness.

Supply chain concentration is a crucial indicator for measuring supply chain relationships and an essential method for supply chain relationship management in enterprises. It mainly encompasses two aspects: customer concentration and supplier concentration (AK & Patatoukas, 2015; Qiu, 2018; Zhang et al., 2020). Previous research on supply chain concentration has primarily focused on its effects on various aspects of enterprises, such as performance, risk, inventory management, financial management, and policy (Irvine et al., 2016; Patatoukas, 2012; Peng et al., 2018; Zhang et al., 2020). Remarkably, studies investigating the impact of supply chain concentration on enterprise performance have not yet reached a consensus (Campello & Gao, 2017; Huang et al., 2016; Kwak & Kim, 2019; Zhou et al., 2019). There exist two different perspectives in this regard. Regarding supplier concentration, Zhang et al. (2020) argued that establishing long-term cooperative relationships between enterprises and suppliers can lead to mutual learning, resource complementarity, risk reduction, acquisition of new technologies, and improved innovation and performance. Conversely, Li et al. (2017) found that supplier concentration, as a risk factor, hinders enterprises from increasing R&D and specific asset

investments. Similarly, with respect to customer concentration, some scholars posit that enterprises' dependence on a few major customers may weaken their bargaining power, negatively affecting innovation and performance (Hui et al., 2018; Irvine et al., 2016). On the contrary, Patatoukas (2012) discovered that customer concentration can reduce the costs associated with searching and selling during transactions, thereby enhancing operational efficiency and profitability. Furthermore, certain researchers suggested a non-linear relationship between customer concentration and enterprise performance (Kwak & Kim, 2019; Zhou et al., 2019). Therefore, investigating the actual impact of supply chain concentration on the performance of listed Chinese manufacturing companies remains an intriguing and worthwhile research topic.

The company's strategy serves as the fundamental basis and starting point for making crucial decisions, significantly influencing its overall behavior (Chandler, 1972). As businesses pursue long-term growth, they continuously adapt their conventional strategies in response to internal and external resource conditions, leading to the development of distinctive resource allocation patterns (Meyer & Rowan, 1977). This process gives rise to a company-specific strategic model (Geletkanycz & Hambrick, 1997), and the degree to which this model deviates from the industry's conventional strategy is referred to as strategic deviation. Extensive prior research has established that the extent of strategic deviation plays a pivotal role in shaping firm performance (Porter, 1980; Deephouse, 1999; Goll et al., 2006; Tang et al., 2011). However, the existing studies have produced inconsistent findings concerning the relationship between strategic deviation and firm performance. For example, Shrader & Simon (1997) identified a negative correlation, implying that strategic deviation reduces a firm's operating performance. In contrast, Goll et al. (2006) reported a positive effect, suggesting that strategic deviation resulting from strategic change can actually enhance a firm's operating performance. Therefore, the underlying mechanisms that elucidate the impact of corporate strategic deviation on firm performance, as well as the intricate interplay between the two, remain uncertain. This calls for further in-depth investigation and refinement to gain a comprehensive understanding.

Trade credit represents a form of relational loan between enterprises and suppliers, falling within the scope of supply chain internal financing and serving as a

crucial source of funding for businesses (Dou et al., 2019). Research findings indicate that suppliers' trade credit financing constitutes around 17% and 25% of total assets for small and medium-sized enterprises (SMEs) in the US and UK, respectively. Additionally, it accounts for approximately 35% and 41% of total debt financing, as well as 50% and 47% of short-term debt financing (Fabbri & Menichini, 2010). The accessibility to trade credit is influenced by various internal and external factors, such as business scale (Petersen & Rajan, 1997), cash flow fluctuations, external financing environment (Harris, 2019), religion, national culture (Markus, 2019), investor sentiment (Huang, Li, & Bai, 2019), financial credit policies, and financial constraints (Hill, 2019). Researchers have primarily explained the existence of trade credit from two perspectives: transaction and financing. From a transaction standpoint, sellers offer trade credit to buyers to save transaction costs, ensure product quality, and implement price discrimination (Petersen & Rajan, 1997; Long et al., 1993; Brennan et al., 1988). For example, large customers may leverage their advantageous position to request price discounts or extended trade credit terms from enterprises (Plehn-Dujowich et al., 2014). Conversely, Zhu & Bai (2018) proposed a negative correlation between supplier concentration and trade credit financing. From a financing perspective, trade credit represents a liquidity source that sellers obtain from buyers. Suppliers, compared to banks and other financial institutions, can gain first-hand information through customer collaboration, effectively reducing information asymmetry. Therefore, trade credit may sometimes be more suitable than bank credit to fulfill enterprises' financing needs (Dou & Zhu, 2012; Murfin & Njoroge, 2015). However, Smith (1987) argued that deeper customer relationships weaken information asymmetry but reduce the supply of trade credit to enterprises. It is evident that there is no unanimous consensus on the influence of supply chain concentration on trade credit financing.

Similarly, there are divergent views on the impact of trade credit financing on enterprise performance. One perspective argues that trade credit financing plays a crucial role in enhancing enterprise performance by mitigating the extent of financing constraints (Guariglia & Mateut, 2006). Through this approach, enterprises can more effectively manage their investment activities, leading to increased growth and improved overall performance. Conversely, some scholars have reached different conclusions. Molina &

Preve (2012) contend that trade credit financing is a costly method of financing. Their research reveals that when companies resort to trade credit under financing constraints, it leads to a decline in their sales revenue. Furthermore, there are findings suggesting a non-linear relationship. Martínez-Sola et al. (2013) examined data from Spanish listed companies and identified an inverted U-shaped relationship between the supply of trade credit financing and enterprise value. Hence, further exploration is necessary to understand the actual impact of trade credit financing on the performance of Chinese manufacturing companies.

In summary, there are several gaps that need to be addressed in the research concerning supply chain concentration, strategic deviation, trade credit financing, and performance. Firstly, the existing literature has not yet reached a consistent conclusion regarding the relationship between these factors, making it a valuable area of investigation. Secondly, previous studies have predominantly examined the impact of trade credit financing and performance from either the perspective of suppliers or customers, but rarely in an integrated manner considering both aspects together. Additionally, there has been limited examination of the combined influence of financing constraints, supply chain concentration, and strategic deviation on firms' trade credit financing. Furthermore, the research methodology in supply chain management-related studies has mainly focused on mathematical model derivation, questionnaire surveys, and qualitative analysis, calling for further empirical research to strengthen the evidence. Therefore, this study aims to empirically test the effects of supply chain concentration and strategic deviation on trade credit financing and firm performance in Chinese manufacturing firms. Additionally, it seeks to explore the moderating role of financing constraints in the relationship between supply chain concentration, strategic deviation, and trade credit financing.

1.2 Purpose of the Study

The objectives of this study are to investigate the impact of supply chain concentration and strategic deviation on trade credit financing and firm performance for listed Chinese manufacturing companies.

1. To investigate the impact of supply chain concentration and strategic deviation on the firms' performance for listed Chinese manufacturing companies.

2. To investigate the impact of supply chain concentration and strategic deviation on trade credit financing for listed Chinese manufacturing companies.

3. To empirically investigate the impact of trade credit financing on the firm performance of Chinese manufacturing listed companies.

4. To examine the mediating role of trade credit financing in the impact of supply chain concentration and strategic deviation on firm performance.

5. To examine the moderating role of financing constraints in the relationship between supply chain concentration and strategic deviation in trade credit financing, as well as its moderated mediation effects.

1.3 Research Questions and Hypotheses

1.3.1 Research Questions

This study presents the following research questions from the perspective of a firm's supply chain concentration, strategic deviation, trade credit financing, and performance.

1. How do supply chain concentration and strategic deviation affect the performance of Chinese listed manufacturing companies?

2. How do supply chain concentration and strategic deviation affect trade credit financing of Chinese listed manufacturing companies?

3. How do trade credit financing affect the performance of Chinese listed manufacturing companies?

4. How do supply chain concentration and strategic deviation affect firm performance through trade credit financing?

5. Do financing constraints play a moderating role in the relationship between supply chain concentration and strategic bias and trade credit financing? Moreover, do financing constraints significantly moderate the mediating effect of trade credit financing?

1.3.2 Hypotheses

From the above research questions, the following hypotheses were formulated for this study.

H1: Supply chain concentration has an impact on firm performance.

H1a: Supplier concentration negatively affects operating performance.

H1b: Supplier concentration positively affects financial performance.

H1c: Customer concentration negatively affects operating performance.

H1d: Customer concentration positively affects financial performance.

H2: Strategic deviation has an impact on firm performance.

H2a: Strategic deviation negatively affects operating performance.

H2b: Strategic deviation negatively affects financial performance.

H3: Supply chain concentration has an impact on a firm's trade credit financing.

H3a: Supplier concentration negatively affects trade credit financing from suppliers.

H3b: Customer concentration negatively affects trade credit financing from customers.

H4: Strategic deviation has an impact on a firm's trade credit financing.

H4a: Strategic deviation positively affects trade credit financing from suppliers.

H4b: Strategic deviation negatively affects trade credit financing from customers.

H5: Trade credit financing has an impact on firm performance.

H5a: Trade credit financing from suppliers positively affects operating performance.

H5b: Trade credit financing from suppliers negatively affects financial performance.

H5c: Trade credit financing from customers negatively affects operating performance.

H5d: Trade credit financing from customers positively affects financial performance.

H6: Firm trade credit financing plays a mediating role in the impact of supply chain concentration and strategic deviation on firm performance.

H6a: Supplier concentration affects firms' operating performance through trade credit financing from suppliers.

H6b: Supplier concentration affects firms' financial performance through trade credit financing from suppliers.

H6c: Customer concentration affects firms' operating performance through trade credit financing from customers.

H6d: Customer concentration affects firms' financial performance through trade credit financing from customers.

H6e: Strategic deviation affects firms' operating performance through trade credit financing from suppliers.

H6f: Strategic deviation affects firms' financial performance through trade credit financing from suppliers.

H7: Financing constraint plays a moderating role in the impact of supply chain concentration and strategic deviation on firms' trade credit financing.

H7a: Financing constraints moderate the relationship between supplier concentration and trade credit financing from suppliers.

H7b: Financing constraints moderate the relationship between customer concentration and trade credit financing from customers.

H7c: Financing constraints moderate the relationship between strategic deviation and trade credit financing from suppliers.

H7d: Financing constraints moderate the relationship between strategic deviation and trade credit financing from customers.

H8: Financing constraints significantly moderate the mediating role of trade credit financing.

H8a: Financing constraints moderate the mediating effect of supplier trade credit financing on the relationship between supplier concentration and firm operational performance.

H8b: Financing constraints moderate the mediating effect of supplier trade credit financing on the relationship between supplier concentration and firm financial

performance.

H8c: Financing constraints moderate the mediating effect of customer trade credit financing on the relationship between customer concentration and firm operational performance.

H8d: Financing constraints moderate the mediating effect of customer trade credit financing on the relationship between customer concentration and firm financial performance.

H8e: Financing constraints moderate the mediating effect of supplier trade credit financing on the relationship between strategic deviation and firm operational performance.

H8f: Financing constraints moderate the mediating effect of supplier trade credit financing on the relationship between strategic deviation and firm financial performance.

1.4 Scope of Study

This study aims to investigate the impact of supply chain concentration and strategic deviation on trade credit financing and firm performance. Additionally, it explores the potential mediating role of trade credit financing between supply chain concentration, strategic deviation, and firm performance, as well as the moderating role of financing constraints. The research focuses on six major categories of manufacturing enterprises listed on the Chinese stock exchange: Petroleum and chemical products industry, Pharmaceutical manufacturing industry, Computer and communications equipment manufacturing, Non-ferrous metal smelting and processing industry, Equipment manufacturing industry, and Electrical machinery and equipment manufacturing industry. These industries are selected due to their clear upstream and downstream supply chain relationships and significant presence in the manufacturing sector. To ensure data accuracy and reliability, the research sample excludes newly listed companies, delisted companies, suspended companies, cases with missing values, and companies displaying extreme financial anomalies. The study period spans from 2013 to 2020, and data are collected from the financial and operational records of the listed companies and CSMAR's database.

1.5 Definition of Terms

1.5.1 Supply Chain Concentration

Supply chain concentration pertains to the level of consolidation and business focus among both upstream and downstream partners in the supply chain. It primarily involves two aspects: supplier concentration and customer concentration. Supplier concentration refers to the extent of consolidation in the number and purchase volume of raw material suppliers from which a company procures its inputs. On the other hand, customer concentration refers to the level of consolidation in the number and sales volume of downstream customers to whom a company sells its products or services.

1.5.2 Strategic Deviation

Strategic deviation refers to the degree to which a company's strategy diverges from the conventional strategic pattern within its industry.

1.5.3 Trade Credit Financing

Trade credit financing pertains to the typical credit arrangements established through deferred payment or prepayment during regular business activities and commodity transactions.

1.5.4 Firm Performance

Firm performance refers to a company's operational and financial performance over a given period of time. This indicator is used to measure the operational and financial performance of a firm, such as gross margin, return on assets (ROA), and return on equity (ROE).

1.5.5 Financing Constraints

A financing constraint refers to a situation where firms face obstacles in obtaining sufficient external financing due to the disparity between their external financing costs and internal financing capabilities, typically arising from information asymmetry.

1.6 Conceptual Framework

The core of this study is the influence of supply chain concentration and strategic deviation on trade credit financing and firm performance, with the following conceptual framework.

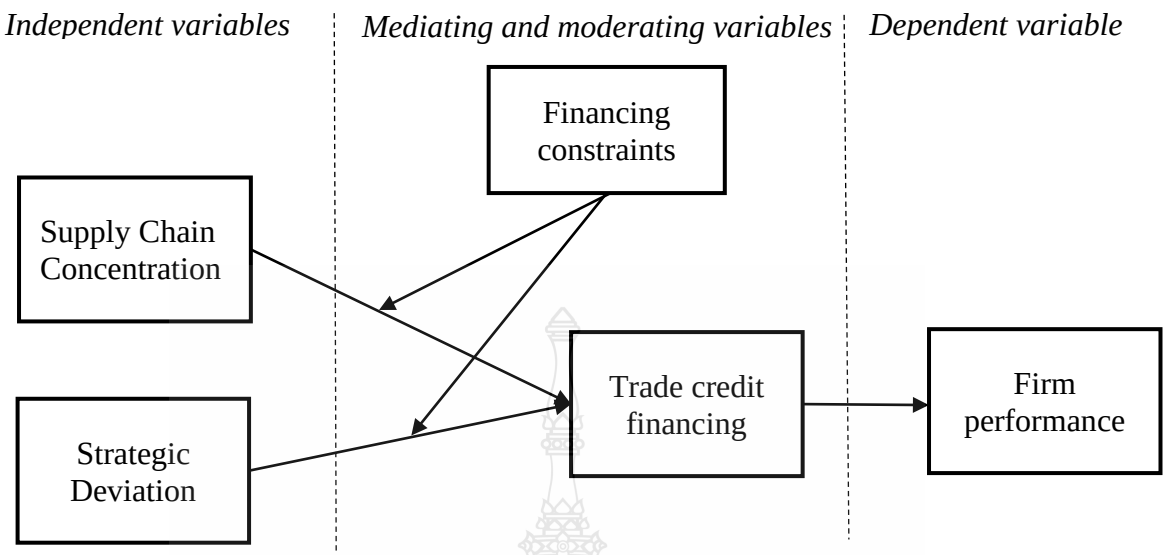

Figure 1.1 The conceptual framework of the study

According to the Resource Dependence Theory (Handfield, 1993), no company can possess all the resources necessary to achieve its goals independently. Businesses must collaborate with each other to obtain the required resources. Hence, companies within the supply chain need to be interdependent and cooperate (Dubois et al., 2008). In the process of resource transactions, trading relationships exhibit distinctive characteristics due to variations in the degree of interdependence among companies, customers, and suppliers. Previous research has often used customer concentration and supplier concentration as key indicators of the important features of company-customer and company-supplier relationships (Patatoukas, 2012; Hui et al., 2018; Zhou et al., 2019). These indicators refer to the dispersion or concentration level of customers and suppliers. Higher concentration indicates a greater dependency on a few major customers and suppliers, while lower concentration implies a more dispersed network with fewer core customers and suppliers.

In resource-dependent relationships, there is an unequal distribution of power in business transactions with both upstream and downstream partners. High customer concentration implies strong bargaining power for customers, which can put businesses at a disadvantage when seeking trade credit financing and potentially negatively impact

their performance. Similarly, when supplier concentration is high, it indicates a deeper dependency on upstream suppliers, giving them more influence in transactions. This, in turn, can affect the trade credit financing obtained from suppliers, ultimately influencing the company's performance.

The theory of information asymmetry suggests that the amount and degree of information related to a transaction are unequal and imbalanced between the two parties, with the party possessing more information being in a better position to profit (Myers & Majluf, 1984; Singh & Agarwal, 2002). On the other hand, strategic deviation in a business refers to the extent to which a company's strategic positioning deviates from traditional industry strategic models (Tang et al., 2011). Viewed from the perspective of information asymmetry, the greater the strategic deviation, the higher the degree of information asymmetry (Carpenter, 2000), making it more challenging for trade credit providers to accurately assess a company's true situation. This also implies that trade credit financing providers face greater uncertainty, leading to a reduced willingness to offer financing support, thereby impacting the scale of a company's commercial credit financing (Ye et al., 2014).

The Transaction Cost Theory posits that transactions between businesses and various parties incur transaction costs (Clemons, 1993). According to this theory, supply chain concentration can enable supply chain integration, information sharing, and specialized investments. In supply chain transactions, the use of trade credit financing by businesses can reduce transaction costs and increase corporate profits (Su, 2012). Furthermore, trade credit financing can also alleviate financial constraints for businesses, allowing them to invest in inventory, fixed assets, and other assets, thus positively impacting corporate performance (Guariglia & Mateut, 2006; Yu, 2013).

The Pecking Order Theory suggests that when businesses seek financing for investment projects, they typically follow specific financing patterns (Myers, 1984). Due to risk considerations, companies often avoid financing through high-risk equity or debt instruments. They first consider internal financing. When internal cash falls short of investment needs, companies prioritize low-risk debt financing, followed by hybrid securities, and only as a last resort, consider high-risk equity financing. In supply chain transactions, due to the presence of financing constraints, companies seek alternative

financing channels such as trade credit as a means of financing (Petersen & Rajan, 1997; Niskanen & Niskanen, 2006). Additionally, when there is significant strategic deviation, investors and creditors tend to be more cautious when making investment decisions about the company. This often leads to higher financing constraints for the company (Li & Shi, 2016). Therefore, financing constraints will modulate the impact of supply chain concentration and strategic deviation on trade credit financing.

1.7 Expected Results

Research on the impact of supply chain concentration on firm performance has gained significant attention. However, most previous studies have only examined its influence on firm performance from either the supplier's or customer's perspective, neglecting the comprehensive analysis of both aspects simultaneously. This study aims to address this gap by incorporating both suppliers and customers into the investigation of their impact on firm performance, seeking to deepen the understanding of the factors influencing performance.

Furthermore, this study delves into the influence of supply chain concentration and strategic deviation on trade credit financing among Chinese manufacturing listed companies, taking into account supply chain concentration as a focal point. By doing so, it aims to enhance theoretical comprehension and provide an empirical basis for exploring the factors affecting corporate trade credit financing.

Additionally, this study adopts an integrated approach, encompassing supply chain concentration, strategic deviation, trade credit financing, and firm performance within the same model. It aims to explore the mediating role of trade credit financing between supply chain concentration, strategic deviation, and firm performance, while also testing the moderating effect of financing constraints on the relationship between supply chain concentration, strategic deviation, and trade credit financing. This research seeks to offer valuable insights for enterprises to manage trade credit financing more effectively. Moreover, the study investigates the interactions and mechanisms among the four factors of supply chain concentration, strategic deviation, trade credit financing, and firm performance, with the goal of providing empirical guidance for firms in formulating scientifically grounded supply chain management strategies to enhance firm performance.

CHAPTER 2
REVIEW OF THE LITERATURE

2.1 Introduction

This chapter focuses on a systematic review of the relevant literature and theory in this study. The first part summarizes the current status of manufacturing firms in China. The second part reviews studies on supply chain concentration and strategic deviation. The third part presents studies on trade credit financing. The fourth part presents studies on financing constraints. Finally, the main theories involved in this study are outlined, including the information asymmetry theory, the transaction cost theory, the resource dependence theory and the pecking order theory.

2.2 Current Situation of China's Manufacturing Industry

2.2.1 The Overall Size of the Sector is Growing, but its Share is Declining

In 2005, the added value of China's manufacturing industry was 6.01 trillion Yuan, accounting for 9.43% of the world's manufacturing share. By 2020, the added value of China's manufacturing industry will reach nearly 30 trillion Yuan, accounting for 29.72% of the world's manufacturing share, and will remain the world's number one manufacturing power for more than ten consecutive years. Among them, China's manufacturing listed companies have made a lot of contributions. 2013 China's manufacturing listed companies less than 600, 2020 manufacturing listed companies have developed to nearly 2,000, an increase of more than 200%. But what is worrying is that from a global perspective, the world's manufacturing value added as a percentage of GDP fluctuates by 16% between 2013 and 2020, and among the five major manufacturing powerhouses - China, the United States, Germany, Japan and South Korea - only China shows a clear downward trend. China's share of manufacturing value added in GDP falls from 31% in 2013 to 25% in 2020.

2.2.2 Deepening of Supply Chain Relationships and Increasing Number of Companies with Aggressive Development Strategies

Listed manufacturing companies have gradually emphasized upstream and downstream cooperation, and supply chain concentration has gradually increased in

recent years, especially customer concentration has increased significantly. This indicates that manufacturing companies have recognised the important role of supply chain concentration in corporate management. In addition, the number of manufacturing enterprises adopting aggressive strategies is increasing. Comparing the asset-liability ratio of listed manufacturing enterprises with the average value of the overall asset-liability ratio of listed manufacturing enterprises, and taking higher than the average value as the criterion, the number of listed manufacturing enterprises with asset-liability ratios higher than the overall average value of manufacturing enterprises has been on an upward trend from 2013 to 2020. This indicates that the number of companies with aggressive behaviour is increasing.

2.2.3 Slower Growth in Manufacturing

The internal problems of China's manufacturing industry are constraining its further development. With rising labour costs and the gradual scarcity of natural resources, it is difficult to promote the continued rapid development of China's manufacturing industry through a crude development model. For example, China's manufacturing industry consumes a lot of resources, environmental pollution is severe, and energy consumption per unit of GDP is about three times the world average. In addition, China's manufacturing industry lacks core competitiveness, has underinvested in research and development, and is highly dependent on foreign technology.

2.3 Review of Supply Chain Concentration and Strategic Deviation Research

2.3.1 Measurement of Supply Chain Concentration

The conceptual definition of supply chain concentration was initially proposed by Lanier et al. (2010), where they defined it as the proportion of a firm's sales contributed by its largest customer relative to the firm's total sales. Although Lanier et al. (2010) highlighted the significance of supply chain concentration and the duration of cooperation as crucial factors influencing a firm's financial performance, their definition of supply chain concentration is limited and fails to consider the interrelationships between the upstream and downstream components of the supply chain.

As the understanding of supply chain concentration has advanced, it is evident that a more comprehensive definition is required to capture the complexity of supply

chain dynamics. While Lanier et al. (2010) focused solely on the largest customer's impact, a holistic approach should also consider the concentration of suppliers and the overall structure of the supply chain. This broader perspective acknowledges the interconnectedness between various partners within the supply chain and their collective influence on a firm's performance.

Therefore, this study has adopted an enhanced and inclusive conceptualization of supply chain concentration that takes into account not only the sales contribution of the largest customer but also the concentration of suppliers and the overall business ecosystem. By doing so, this study aims to provide a more comprehensive understanding of the multifaceted role that supply chain concentration plays in shaping firm performance. According to existing studies, supply chain concentration mainly refers to the number of partners up and down the supply chain and the degree of business concentration of a firm, which mainly includes supplier concentration and customer concentration (Kwak & Kim, 2019; Zhang et al., 2020). Supplier concentration refers to the number of upstream suppliers from which a firm purchases raw materials and the degree of concentration of purchasing volume. A high supplier concentration indicates that the number of suppliers with whom the firm works is small and that a larger share of purchases are made from major suppliers (Kähkönen et al., 2015). Customer concentration, on the other hand, is the number of downstream customers to whom a firm sells its products and the degree of concentration of sales volume. A high customer concentration indicates that a firm has a small number of customers and a larger proportion of total sales revenue from sales to key customers (Huang et al., 2016; Hui et al., 2018).

In terms of customer concentration, various scholars have employed different measures to study its impact on firm performance. Patatoukas (2012) utilized the Herfindahl index of sales revenue from major customers to gauge customer concentration and found that large customers can positively influence firm profitability. Similarly, Itzkowitz (2013) adopted a similar approach to Patatoukas (2012) and discovered that customer concentration is associated with increased cash holdings in firms. Campello & Gao (2017) examined the relationship between customer concentration and loan maturity, using the proportion of sales to large customers, where large customers were defined as

those contributing more than 10% of total sales. Chen et al. (2015) investigated the impact of customer concentration on equity capital, utilizing the sales share of the top five customers (Top5) and the Herfindahl index of operating income of the top five customers.

On the other hand, when studying supplier concentration, numerous scholars have defined it as the ratio of purchases from the top five suppliers to the total purchases (Tang, 2009; Wang & Liu, 2016; Ren et al., 2019). It is worth noting that while these previous studies have shed light on the relationship between supply chain concentration and firm performance, the focus has been primarily on customer concentration or supplier concentration in isolation. In our study, we seek to comprehensively explore the joint influence of both customer and supplier concentration on trade credit financing and firm performance. By integrating these two perspectives, we aim to provide a more comprehensive understanding of how supply chain concentration affects the financial and operational aspects of firms.

Based on the practice of Campello & Gao (2017), Zhou et al. (2019), in this research, the proportion of the top five major suppliers to the total purchase amount of the firm in the current period is selected to measure the supplier concentration. Customer concentration is assessed by calculating the percentage of sales revenue generated from the top five customers in relation to the total sales of the company.

2.3.2 Measurement of Strategic Deviation

Corporate strategic deviation is the extent to which a firm's strategic positioning deviates from the industry's conventional strategic model (Finkelstein & Hambrick, 1990; Tang et al., 2011). A firm's strategic deviation depends largely on its structural differences in resource allocation and hence differences in resource allocation across strategic dimensions (Finkelstein & Hambrick, 1990; Tang et al., 2011). There are two main approaches to measuring the degree of strategic variance, Bentley's (2013) strategic assignment approach and the dimensional approach (Geletkanycz & Hambrick, 1997; Carpenter, 2000; Zhang & Rajagopalan, 2010; Tang et al., 2011), creating a measure of a composite indicator of strategic deviation. Three main criteria for selecting strategic dimension indicators are included in the available studies: firstly, four strategic dimension indicators (Zhang & Rajagopalan, 2010), including advertising and promotion cost investment, capital intensity, degree of fixed asset renewal, and financial leverage. The

second is the six strategic dimensions (Finkelstein & Hambrick, 1990; Tang et al., 2011), which include investment in advertising and promotion, investment in R&D, capital intensity, degree of renewal of fixed assets, overhead investment, and financial leverage. Thirdly, there are seven strategic dimension indicators (Carpenter, 2000), including advertising and promotion cost investment, R&D cost investment, degree of fixed asset renewal, overhead cost investment, financial leverage, international market operations, and inventory.

This study refers to Geletkanycz & Hambrick (1997) and Tang et al. (2011) method of measuring strategic deviation to measure the actual strategic model adopted by firms in six dimensions: advertising intensity X_1 (sales expenses/operating revenue), degree of innovation X_2 (net intangible assets/operating revenue), capital intensity X_3 (net fixed assets/number of employees in the firm), renewal of fixed assets X_4 (net fixed assets/original value of fixed assets), overhead expenses X_5 (overhead expenses/operating revenue), and financial leverage X_6 (sum of short-term borrowing, long-term borrowing and bonds payable/equity book).

This study first standardise the values of each dimension, i.e. adjusting the dimensional values by subtracting the industry average for the year, then dividing by the industry standard deviation, and taking the absolute value of each dimensional indicator after standardisation to obtain the extent to which the strategic positioning of each listed company deviates from the industry average for the current period, and finally taking the arithmetic mean of the data of these 6 dimensions to obtain the strategic deviation indicator (denoted by SD). Each dimension reflects the company's strategy from one side, and the formula for calculating each dimension is shown in Table 2.1.

Table 2.1 Dimensional definition of strategic deviation

Dimension X	**Calculation formula**
Advertising intensity X_1	Sales expenses/operating revenue
Degree of innovation X_2	Net intangible assets/operating revenue
Capital intensity X_3	Net fixed assets/number of employees in the firm
Renewal of fixed assets X_4	Net fixed assets/original value of fixed assets
Overhead expenses X_5	Overhead expenses/operating revenue
Financial leverage X_6	sum of short-term borrowing, long-term borrowing and bonds payable/book value of equity

The calculation model is as follows:

$$SD=\{\left|\left(\frac{SE}{OR}-\partial_1\right)/\sigma_1\right|+\left|\left(\frac{NIA}{OR}-\partial_2\right)/\sigma_2\right|+\left|\left(\frac{NFA}{NE}-\partial_3\right)/\sigma_3\right|+\left|\left(\frac{NFA}{OFA}-\partial_4\right)/\sigma_4\right|+\left|\left(\frac{OE}{OR}-\partial_5\right)/\sigma_5\right|+\left|\left(\frac{SB+LB+BP}{BVE}-\partial_6\right)/\sigma_6\right|\}/6$$

In the above formula, SE represents sales expenses, OR represents operating revenue, NIA represents net intangible assets, NFA represents net fixed assets, NE represents number of employees, OFA represents original value of fixed assets, OE represents overhead expenses, SB, LB, BP and BVE refer to short-term borrowings, long-term borrowings, bonds payable and book value of equity respectively, and ∂ and σ represent the industry average and industry standard deviation respectively.

In this study, six dimensions were selected to derive the strategic deviation data for each company using the strategic deviation measurement model, which is a continuous type of variable.

2.3.3 Supply Chain Concentration and Firm Financial Activity

Existing research has increasingly acknowledged the significance of supply chain concentration on firms, with the majority of studies concentrating on its impact on corporate cash holdings, capital structure, corporate performance, dividend distribution, M&A performance, and surplus management (AK & Patatoukas, 2016; Campello & Gao, 2017; Schwieterman et al., 2018).

The impact of supply chain concentration on firm financial performance has been explored in several studies. Patatoukas (2012) suggests that customer concentration can enhance firm profitability by reducing selling expenses and optimizing asset utilization. On the other hand, Kim & Zhu (2018) found a negative association between customer concentration and financial performance, indicating that heavy reliance on large customers can lead to increased cash flow uncertainty and potential risks if these customers are lost suddenly. Panos (2012) investigated the relationship between customer concentration and stock market value and found a positive correlation between customer concentration and a firm's stock return. This suggests that higher customer concentration may improve firm efficiency and market performance, leading to higher firm value.

In the research on the relationship between supply chain concentration and firm operational performance, Koufteros et al. (2005) conducted a study on 244 manufacturing companies in the United States and found that both supplier concentration and customer concentration had a negative impact on firm operational performance. Similar findings were observed by Fabbe-Costes & Jahre (2008), who noted that higher supply chain concentration did not enhance the operational performance of companies and, in some cases, even had a detrimental effect. Empirical research conducted by Parente et al. (2011) also supported the notion that high supply chain concentration could inhibit a company's operational performance.

Furthermore, Tang (2009) examined Chinese firms and identified a curvilinear relationship between customer concentration and supplier concentration with firm performance. The study revealed a positive U-shaped relationship between customer concentration and firm performance, and an inverted U-shaped relationship between supplier concentration and firm performance. Yli-Renko & Janakiraman (2008) proposed the resource dependence theory, indicating that excessive dependence on large customers could give these customers stronger bargaining power, potentially leading to less favorable terms for the firm and negatively impacting its performance.Additionally, Chen & Wang (2014) found that supply chain integration can reduce period costs, enhance asset turnover, improve asset utilization efficiency, and ultimately increase the return on assets of the firm, positively influencing its financial performance.

Supply chain concentration has an impact on cash holdings and increases the level of cash holdings when a company has significant customers. Itzkowitz (2013) found that if a customer accounts for a significant portion of a firm's sales revenue, the loss of that customer could have a significant impact on the firm's financial position. To reduce the potential operational risk that this important customer may pose to the firm, suppliers with significant customer relationships are more likely to hold more cash, and the amount of cash held increases proportionally with the importance of the customer relationship. Cohen & Li (2014) used US data found that the reasons why firms hold cash may be related to customer orientation, especially with the government, that firms that have the government as their main customer will hold less cash and have more stable future earnings, and that the firm's suppliers will provide less trade credit considering the firm's

relationship with the government. Bae & Wang (2015) found that firms make certain investments in dedicated assets to suppliers in order to build strong relationships, and these investments cause firms to incur higher financial distress costs, which in turn cause firms to hold higher amounts of cash. Similarly, Wang & Liu (2016) found that the closer a firm's relationship with its suppliers, the more cash the firm holds, and that close supplier relationships lead to more cash being held by firms with lower market positions. Li et al., (2016) explored the impact of upstream and downstream relationships in the supply chain on firms' cash holding behavior from the perspective of cooperation and risk and showed that manufacturing firms hold more cash due to risk considerations.

Supply chain concentration significantly influences a firm's capital structure decisions. Corporations can use reduced debt as a commitment mechanism to suppliers and customers, while increased debt can enhance their negotiation power. The firm's interactions with non-financial stakeholders also play a role in shaping its capital structure choices. For instance, Titman (1984) highlights that stakeholders consider a firm's bankruptcy risk when making relationship investments. Higher capital structure implies increased bankruptcy risk, leading firms to reduce their debt levels to attract more relationship investments from stakeholders.

Banerjee et al. (2008) found that firms engaged in bilateral relationships are more likely to produce or source unique products, especially in the durable goods industry. These firms tend to maintain lower financial leverage to mitigate their own risk and induce suppliers and customers to make relationship-specific investments. Kale & Shahrur (2007) examined the association between a firm's financial leverage and characteristics of suppliers and customers. They found that debt can act as a commitment mechanism or enhance negotiating power. Firms may reduce their debt to act as a commitment mechanism, encouraging suppliers and customers to make more relationship-specific investments. Alternatively, firms may increase their debt to strengthen their negotiating power.

Moreover, the research revealed that a firm's financial leverage is negatively related to the research and development (R&D) intensity of suppliers and customers. In industries with frequent strategic alliances and joint ventures, firms tend to have lower

debt levels. However, debt also plays a negotiating role, as a firm's debt level is positively correlated with the industry concentration of suppliers or customers.

Brown et al. (2009) demonstrated that leveraged acquisitions can increase a firm's bargaining power with suppliers. Announcements of leveraged acquisitions by downstream firms result in abnormal losses for upstream firms, particularly those that have invested more in relationships. This effect is less pronounced for suppliers involved in commodity deals or shorter-term contracts.

In addition, supply chain concentration can have an impact on the dividend distribution, mergers and acquisitions, and surplus management of companies. Wang (2012) investigated how a firm's relationship with its major customers/suppliers affects its dividend payment policy and finds that firm-customer relationships have a negative relationship with dividend payments, mainly because building customer relationships requires additional dedicated investment and to ensure that the firm has sufficient funds, the firm needs to reduce dividend payments to ensure that the firm has sufficient free cash flow. When a company makes mergers and acquisitions of major suppliers and customers it will improve the competitiveness of the company. Shahrur (2005) examined the wealth effects of corporate mergers and acquisitions involving competitors, suppliers, and customers. The study found that mergers and acquisitions can generate positive abnormal returns for competitors, suppliers, and customers. Additionally, mergers and acquisitions can increase the purchasing power of the combined firm if suppliers are more concentrated. Fee & Thomas (2004) studied the effects of mergers and acquisitions involving suppliers, customers, and competitors on stock market reactions and operational performance. The study found no evidence that mergers and acquisitions increase the level of monopolistic collusion between the firm and the acquired party. However, they do increase the firm's productivity and improve the firm's purchasing power. Cheng & Eshleman (2014) examined how a firm's shareholders react to earnings information released by the firm's major customers and found that a firm's shareholders overreact to earnings news from the firm's customers and that corporate investors' overreaction to customer earnings disclosure decreases when the firm's economic ties with its customers are strengthened.

To mitigate the adverse effects of information asymmetry, many of the current Chinese listed manufacturing companies aim to enhance their supply chain concentration. As a result, based on transaction cost theory and information asymmetry theory, this study proposes a hypothesis that posits a significant relationship between supply chain concentration and firm performance. Specifically, based on the research findings of Koufteros et al. (2005) and Parente et al. (2011), this study predicts that in the Chinese manufacturing sector, both supplier concentration and customer concentration will have a negative impact on firm operational performance. However, in terms of firm financial performance, they are expected to have a positive influence, as indicated by previous studies (Patatoukas, 2012; Kim & Zhu, 2018). Therefore, the hypotheses are as follows:

H1a: Supplier concentration negatively affects operating performance.

H1b: Supplier concentration positively affects financial performance.

H1c: Customer concentration negatively affects operating performance.

H1d: Customer concentration positively affects financial performance.

2.3.4 Strategic Deviation and Firm Performance

Strategy is a key factor that influences a firm's business behaviour (Porter, 1991), and firms with different strategic deviation inevitably have different business performance. Shrader & Simon (1997) found that strategic deviation is negatively related to business performance, i.e. strategic deviation reduces a firm's business performance. Geletkanycz & Hambrick (1997) also argued that firms with large strategic deviation generate greater information asymmetry and the firm's performance is likely to be worse.

In contrast, Deephouse (1999) argued that a large strategic deviation helps firms to gain a unique competitive position, face fewer competitors or even form monopolies, and have relatively less competition in terms of access to resources, all of which are favourable factors for firms to improve their performance. Similarly, Goll et al. (2006) found that strategic deviation can have a positive impact on business performance and that the degree of strategic differentiation due to strategic change can improve a firm's business performance.

Alternatively, it has been argued that strategic deviation is not related or non-linearly related to firm performance. For example, Hunt (2000) found that strategic bias did not significantly affect a firm's business performance. Zhang & Rajagopalan (2010)

found that the relationship between strategic deviation and operating performance is not simply linear, but rather an inverted U-curve relationship, i.e. the relationship between strategic deviation and operating performance changes from positive to negative as the strategic deviation of the firm increases.

Encouragingly, scholars have further explored the impact of firm strategic deviation on the volatility of operating performance and have reached the consistent conclusion that firms with greater strategic deviation have greater volatility in operating performance compared to firms with less strategic deviation. For example, Hiller & Hambrick (2005) and Tang et al. (2011) both concluded that strategic bias increases the volatility of firms' financial performance, and that the greater the strategic bias, the greater the uncertainty in the firm's operations and hence the greater the likelihood of achieving extreme performance (well above or below the industry average level of performance). Li & Zeng (2017) also reached similar conclusions: that strategic deviation was significantly and positively related to both vertical and horizontal volatility in firm performance.

The acquisition of differentiated competitive advantages is often not achieved in the short term. At present, Chinese manufacturing firms generally face serious information asymmetry, and firm strategies that deviate from industry averages are often interpreted negatively by upstream and downstream partners. Therefore, based on the information asymmetry theory, this study argues that strategy deviation negatively affects firm performance. Hence, the hypotheses are as follows:

H2a: Strategic deviation negatively affects operating performance.

H2b: Strategic deviation negatively affects financial performance.

2.4 Research Related to Trade Credit Financing

Trade credit financing refers to a common credit arrangement used by enterprises during normal business activities and commodity transactions, involving deferred payments or advance receipts. Essentially, trade credit financing provides short-term credit to enterprises by their upstream or downstream partners. It serves as a means to alleviate firms' financing constraints, especially when they face credit rationing from banks due to information asymmetry (Biais & Gollier, 1997; Fisman & Love, 2003;

Burkart & Ellingsen, 2004). In developed countries like the United States, trade credit financing is a prominent form of short-term external financing (Perterson & Rajan, 1997). In developing countries with limited financial development, trade credit financing becomes an effective alternative to bank credit, playing a vital role in easing firms' financing constraints (McMillan & Woodruff, 1999; Shi & Zhang, 2010). Companies engage in trade credit financing with suppliers and customers for two main motives: cooperative and competitive motives.

2.4.1 Based on Collaborative Motivation

From the perspective of cooperative motives, the existence of trade credit financing stems mainly from financing motives, marketing motives, motives to reduce transaction costs, motives to achieve price discrimination, and motives to provide quality assurance.

In terms of financing motives, trade credit is largely driven by credit rationing (Petersen & Rajan, 1997; Biais & Gollier, 1997). When firms face difficulties in obtaining bank loans, they turn to suppliers, making trade credit an important alternative financing method (Petersen & Rajan, 1997). Studies by Ge & Qiu (2007), Yu & Pan (2008), and Wang & Lin (2008) support this alternative financing theory. Suppliers play a significant role in providing trade credit financing to companies and possess a monitoring advantage over banks due to their access to more comprehensive company information. Burkart & Ellingsen (2004) argued that suppliers can more reliably monitor inventories or fixed assets compared to cash flows, making them better-equipped to monitor firms than banks. Schwartz & Whitcomb (1977) suggested that suppliers have a stronger supervisory advantage since they have access to information at a lower cost than other borrowers, making them more willing to provide trade credit financing. Studies by Ono (2001), Uesugi (2005), and Tsuruta (2008), using Japanese data, also showed that business credit increased as corporate bank loans decrease.

Cunat (2007) found that suppliers provide more trade credit to customers when the latter face liquidity shocks to maintain their relationships. Wilner (2000) argued that when customers encounter financing difficulties, firms relying on them will offer more concessions in debt negotiations. Tsuruta (2013) found that close customer relationships are beneficial for small businesses, and they provide less trade credit to customers during

economic downturns, financial distress, or when bank borrowing rates are high. Maintaining a strong relationship with a dependent supplier incentivizes major customers to make proactive payments and provide cash flow to the supplier (Banerjee et al., 2004). Similarly, Miwa & Ramseyer (2008) suggested that firms use trade credit as a way to adapt to financial shocks, such as reducing accounts receivable transactions.

Molina & Preve (2009) studied the accounts receivable transaction policies of distressed firms and found that suppliers with higher financing constraints were more likely to reduce accounts receivable transactions to alleviate cash flow problems. Petersen & Rajan (1997), Molina & Preve (2009), and Rodríguez & Olga (2006) observed that firms with easier access to bank borrowing provide more trade credit to customers and reduced the supply of trade credit to customers when the firm was in financial distress.

Trade credit financing is also driven by marketing motives, as it serves as a marketing tool to boost sales and establish stable relationships with suppliers and customers. The concept of trade credit as a sales strategy was first suggested by Nadiri (1969). Schwartz (1974) viewed trade credit financing as an essential component of a firm's pricing policy, where allowing customers to defer payments could increase customer demand for the product. Trade credit can also be employed as a competitive tool, enabling firms to compete on price by offering disguised price reductions, and allowing price discrimination among different customers through extended payment terms without penalties or additional discounts (Schwartz & Whitcomb, 1977).

Furthermore, the provision of trade credit can stimulate sales by enabling customers to experience the product's quality before making payment (Long et al., 1993; Deloof & Jegers, 1996). Schwartz (1974) proposed that firms with easier access to finance have an incentive to extend trade credit to customers to increase sales or secure future sales. This supports their customers' growth and expands the potential market size, thus overcoming the limitations on suppliers' own growth imposed by the size of the sales market. Additionally, Summers & Wilson (2003) argued that firms with longer-term relationships with suppliers and customers are granted better and more favorable trade credit financing. Trade credit financing can attract and retain customers while meeting specific marketing objectives for the product. Fisman & Raturi (2004) put forward the competitive business credit hypothesis, suggesting that firms are motivated to offer trade

credit as a competitive strategy in the market. This is particularly prevalent among SMEs and start-ups, who use trade credit as a means to gain a competitive edge.

Trade credit financing based on the motive of reducing transaction costs. The use of trade credit can improve the efficiency of transactions and reduce transaction costs. In an information-asymmetric market, customers and suppliers can use trade credit to obtain information to assess the possible risks of a transaction (Smith, 1987; Petersen & Rajan, 1997; Ng et al., 1999), where the seller needed to determine the creditworthiness of the buyer to ensure that payment will be received and the buyer needs to be sure that the value of the purchased goods is credible. Ferris (1981) argued that transactions have uncertainty, and firms will maintain sufficient cash and inventory to hedge uncertainty over a certain period of time to ensure that transactions can continue. The use of trade credit allows both parties to specify the point at which cash will flow in, thus reducing the precautionary investment made by suppliers and customers to hedge uncertainty, and the cumulative payment of trade credit allows customers to strictly comply with the credit repayment period, reducing transaction costs for both parties. Petersen & Rajan (1997) argued that through the use of trade credit, firms do not have to settle payments for goods at each transaction, allowing them to separate the payment cycle from the goods flow cycle, thereby reducing the inventory that needs to be stored, reducing the cost of keeping inventory and the financing costs required for large purchases of inventory, and reducing firms' transaction costs. Emery (1984) argued that suppliers and customers can bypass the non-competitive rents of financial institutions through trade credit supply.

Trade credit based on achieving price discrimination. Trade credit can be widely used as a screening mechanism for indirect price discrimination (Brennan et al., 1988). Schwartz & Whitcomb (1977) also argued that trade credit can be used for price discrimination and can be seen as a contractual mechanism to address information asymmetries in intermediate goods markets, where the customer's choice of trade credit term can convey information about the risk of default to the supplier, who can use this information to protect investments that may not be recoverable. Ferris (1981) pointed out that the trade credit period can be used as a price adjustment mechanism, so that if the buyer does not pay for the goods during the discount period, then the seller can increase the sales price without actually having to default.

Trade credit based on quality assurance motives. The provision of trade credit by suppliers to customers can be seen as a commitment mechanism to ensure that the products supplied by suppliers to customers meet quality requirements. Since information asymmetry between upstream and downstream firms may lead to adverse selection problems, downstream customers cannot identify the product quality of upstream suppliers, and suppliers with quality problems may transfer quality risks by increasing discount rates to induce customers to pay in time (Lee & Stowe, 1993), therefore, trade credit financing can be used as a signaling mechanism by which upstream suppliers can trade credit financing can be used as a signaling mechanism whereby upstream suppliers can convey the message of higher product quality by offering trade credit financing to downstream customers who can refuse to pay if there is a problem with product quality during the credit period, thus trade credit financing can reduce adverse selection problems. Ferris (1981) found that trade credit protects the customer by ensuring that the supplier can comply with the contract with the customer, that the buyer has sufficient time to inspect the goods during the credit period, and that the product is of reliable quality or that the service has been performed correctly, which may be more important for geographically separated buyers and sellers. Smith (1987) argued that trade credit periods can be used as a signal from sellers to customers about product quality, and that quality suppliers cannot be identified in advance when they do not have sufficient reputation to provide customers with product quality guarantees. Lee & Stowe (1993) found similar findings, where low-quality producers may shift product risk by offering higher discounts to induce buyers to pay earlier. Long et al. (1993) argued that trade credit can serve as an implicit quality assurance mechanism for buyers to control the quality of the seller's products, and the sales discount rate can signal the quality of the producer's products. Producers of high-quality products may be more willing to offer contracts with low discounts and long repayment terms to signal the high quality of their products, so that buyers can judge the quality of their products by the trade credit repayment terms offered by the seller and thus choose a reliable supplier.

2.4.2 Based on Competitive Motives

When suppliers, customers, and enterprises are in a competitive relationship, the primary suppliers and customers of enterprises will encroach on the liquidity of

enterprises to obtain more revenue in the supply chain revenue distribution. The main suppliers of enterprises will request timely payments and more advance payments, while the main customers of enterprises will request more credit and extended payment periods. Corporate trade credit financing is related to the negotiation ability of both sides of the transaction. The weaker the negotiation ability of the enterprise relative to its suppliers and customers, the less Trade credit financing the enterprise has, and the more Trade credit supply the enterprise provides to its suppliers and customers. Fabbri & Menichini (2010), Giannetti et al. (2011), and Love et al. (2007) argued that the large and widespread presence of trade credit is mainly associated with strong buyers. Giannetti et al. (2011) found that the market position of buyers and sellers has a significant impact on trade credit terms. Summers & Wilson (2002) found from an empirical study of 655 firms in the UK that most firms use trade credit as an inexpensive source of financing, and when firms have a market position and their suppliers have a low market position and weak bargaining power, firms use methods such as deferred payment to demand more trade credit from their suppliers.Using data from a World Bank survey of Chinese firms, Fabbri & Klapper (2008) found that firms with a competitive advantage and greater bargaining power in the marketplace are more likely to obtain business credit from suppliers. Wilson & Summers (2002) found that firms with a high bargaining position are offered more favorable business credit. Summers et al. (2003) found that the stronger the customer's strong bargaining power, the more business credit the firm supplies to the customer. Using data from the United States, Burkart et al. (2011) found that the more exclusive a firm's product is to its customers, the more business credit the firm supplies to its customers, while the more homogeneous the range of products a firm sells, the less exclusive the product is to its customers, and the less business credit the firm supplies to its customers. Conversely, the weaker the firm's bargaining power, the less trade credit is financed and the more trade credit is provided to suppliers and customers (Fabbri & Klapper, 2008).

2.4.3 Supply Chain Concentration and Trade Credit Financing

In supply chain transactions, there are both cooperative and competitive relationships between companies and their upstream suppliers and downstream customers (Nalebuff et al., 1996). When suppliers or customers have a favourable position in the chain, they all want to gain more and the take up of trade credit facilities will be more

obvious (Nagarajan & Bassok, 2008). Many scholars discussed the impact of supply chain concentration on corporate trade credit financing in terms of bargaining power (Burkart & Ellingsen, 2004).

Mekzer (1960) believed that trade credit financing is a preferential and price reduction benefit from the supplier to the customer, based on the theory of price discrimination. Therefore, trade credit financing is used as an important pricing strategy to identify different customers. As Petersen & Rajan (1997) pointed out: trade credit policies are indirectly differentiated pricing applied by suppliers to their customers. McMillan & Woodruff (1999) and Cunat (2007) argued that the strength of suppliers is very relevant to the trade credit facilities they provide. Piercy & Lane (2006) found that when suppliers are strong, suppliers may want firms to accelerate the repayment of amounts owed. Fabbri et al. (2008) argued that those suppliers who provide trade credit financing to their customers for operational motives tend to have a weaker market position and provide a higher proportion of credit sales. Giannetti et al. (2011) argued that the larger the supplier sells to the firm, the weaker the firm's ability to obtain trade credit financing. Similarly, Hirofumi et al. (2013) found that when firms were more dependent on their main suppliers, the willingness of suppliers to provide trade credit financing diminishes.

In terms of customers, Horen (2010) found that powerful firms tend to request suppliers to sell goods on credit. Similarly, Giannetti et al. (2011) stated that customers may expect firms to provide more trade credit financing when customer concentration is high. Fabbri & Klapper (2016) also argued that if a firm is an important customer, greater reliance will compel it to provide more trade credit financing. Wilner (2000) and Dass et al. (2015) similarly argued that when customers are stronger, they are likely to make more favorable demands on their suppliers, such as increased credit sales, longer collection periods for amounts owed, and reduced cash sales, prompting firms to provide more trade credit financing to their customers.

Based on the resource dependence theory, it can be observed that supply chain concentration is closely related to the trade credit financing obtained by businesses. Specifically, when supplier concentration is high, it indicates that businesses rely more on suppliers. Suppliers' strong bargaining power often compels businesses to expedite

payment, resulting in reduced trade credit financing provided to businesses (Giannetti et al., 2011; Hirofumi et al., 2013). Similarly, when customer concentration is high, customers have strong bargaining power, and they may expect businesses to offer more favorable payment policies, such as increasing credit sales or extending accounts receivable collection periods (Dass et al., 2015; Fabbri & Klapper, 2016). This will lead to a decrease in trade credit financing from customers. Therefore, this study anticipates that supplier concentration and customer concentration will have negative impacts on trade credit financing from suppliers and trade credit financing from customers, respectively. Thus, the hypotheses are as follows:

H3a: Supplier concentration negatively affects trade credit financing from suppliers.

H3b: Customer concentration negatively affects trade credit financing from customers.

2.4.4 Strategic Deviation and Trade Credit Financing

Deviating from the industry norm means that firms are exposed to higher business risks. Industry conventional strategy is a prudent choice made by firms in the industry based on their own experience (Miller et al., 1996). Following the industry average helps firms to adapt better to the external environment and avoid uncertainties as much as possible, thus increasing their viability. Deviating from the industry's conventional strategy means incurring more time and capital costs for the firm, making resource reallocation more costly, challenging, and risky (Zhang et al., 2010). In addition, the implementation of unconventional competitive strategies is likely to provoke hostile reactions from competitors (Miller et al., 1994), which in turn affects the firm's trading activities with stakeholders and increases operational risk. In turn, a firm's major creditors will decide on the financing support to be provided to the firm based on its risk level in order to reduce the risk of credit default (Wang et al., 2017), which also means that firms with greater strategic deviation face higher financing costs and greater financing difficulties.

From the perspective of information asymmetry, higher strategic deviation implies an increased difficulty for business credit providers to accurately identify the true state of the firm. According to existing research, the higher the strategic deviation, the

higher the information asymmetry (Carpenter, 2000) and the greater the volatility of the firm's performance (Tang et al., 2011). A firm's strategic positioning can reflect its capital allocation, and deviation from industry conventional strategies mean that external investors have difficulty in inferring a firm's level of development through industry conventional standards, and their cost of gathering information is significantly higher, which also diminishes the incentive for external stakeholders to attempt to mitigate information asymmetry (Wang et al., 2017). Hou et al. (2020) based on the spillover effects of the impact of firm strategy implementation found that increased difficulty in interpreting corporate information by external suppliers significantly inhibits the size of a firm's commercial credit financing. Ye et al. (2014) showed that investors are concerned with strategic information alongside corporate financial information, and the greater the strategic deviation of a firm, the higher the operational risk, and the more severe the information asymmetry problem, the greater the uncertainty faced by commercial credit financing providers, the lower the willingness to provide financing support, and therefore the reduced scale of trade credit financing obtained by enterprises.

Based on information asymmetry theory, the greater the strategic deviation of a company, the higher the level of information asymmetry it faces, often accompanied by greater risks (Zhang et al., 2010; Wang et al., 2017). According to industry conventions, suppliers and customers often find it challenging to identify a company's strategic intent. Due to risk considerations, they may reduce the supply of trade credit financing. Therefore, this study anticipates that strategic deviation may have a negative impact on the trade credit financing obtained by businesses. Thus, the hypotheses are as follows:

H4a: Strategic deviation positively affects trade credit financing from suppliers.

H4b: Strategic deviation negatively affects trade credit financing from customers.

2.4.5 Trade Credit Financing and Firm Performance

By using trade credit financing, firms can reduce transaction costs (Ferris, 1981), ease financing constraints (Huang et al., 2022), adjust their capital structure, optimise resource allocation, generate operating and financing benefits, and ultimately positively influence firm performance. Stiglitz & Weiss (1981) pointed out that some firms do not have easy access to loans from financial institutions such as banks due to

information asymmetries. As a result, the vast majority of firms prefer trade credit financing, which reduces business costs, increases productivity, and thus improves firm performance. According to Wemerfelt's (1984) and Bamey's (1991) resource-based view theories, credit is a scarce resource that can confer value and cannot be easily imitated or replaced in other ways, from which it can be deduced that trade credit financing, as the basis of corporate credit, is known to have an impact on the performance of firms. Petersen & Rajan (1997) pointed out that the ease of access and flexibility of trade credit financing make it advantageous in terms of debt financing, which positively contributes to the improvement of business performance. Studies by Schwartz (1974) and Ferris (1981) pointed out that the use of trade credit financing by buyers can reduce a firm's cash reserves, lower costs, and thus increase corporate profits. Su (2012) found that the use of trade credit can reduce a firm's costs and increase corporate profits.

A study conducted by Marotta et al. (2000) revealed that the frequency of using trade credit is higher when firms face more severe financing constraints. Business credit, in turn, positively impacts firm performance by alleviating the extent of financing constraints (Biais & Gollier, 1997; Petersen & Rajan, 1997). This enables firms to structure their investment activities more effectively, leading to increased growth and ultimately enhancing firm performance. Xi & Zhang (2011) also argued that trade credit exhibits a negative relationship with financing constraints, indicating that trade credit, as a form of external financing, helps mitigate firms' financing constraints.

Moreover, Molina & Preve (2012) investigated trade credit financing in transactions with suppliers under conditions of financing distress and found that trade credit constitutes a significant proportion of short-term financing. It plays a crucial role in managing financing distress, with distressed firms heavily relying on trade credit as a substitute for bank borrowing. Smaller and less competitive firms, particularly those facing financing distress, tend to use trade credit financing more frequently.

Trade credit financing can also enhance firm performance by reducing the firm's financing constraints and allowing the firm to have funds to increase investment in inventory, fixed assets, and other assets (Guariglia & Mateut, 2006; Nilsen, 2002). Similarly, Yu (2013), by examining the impact of trade credit financing on firm growth and whether the relationship network facilitates the use of trade credit financing, found

that the use of trade credit financing by firms alleviates financing constraints and promotes firm growth, which is more pronounced for firms with financing needs.

Based on transaction cost theory and pecking order theory that the use of trade credit can reduce enterprise costs, improve productivity, increase profits, and consequently enhance corporate performance (Su, 2012). Moreover, trade credit financing can also prompt enterprises to have more funds for increasing investments in inventory, fixed assets, and other assets, thus improving corporate performance (Guariglia & Mateut, 2006). Therefore, the hypotheses are as follows:

H5a: Trade credit financing from suppliers positively affects operating performance.

H5b: Trade credit financing from suppliers negatively affects financial performance.

H5c: Trade credit financing from customers negatively affects operating performance.

H5d: Trade credit financing from customers positively affects financial performance.

As discussed earlier, supply chain concentration and strategic deviation can affect the amount of trade credit financing a firm can obtain (Hirofumi et al., 2013; Wang et al., 2017; Lee et al., 2018). Contemporary empirical studies consistently validate that by deploying trade credit financing, firms can curtail transactional costs (Ferris, 1981), assuage financing constraints (Huang et al., 2022), and engender operational and financing benefits via strategic adjustment of capital structure and optimal resource allocation, ultimately exerting a positive influence on firm performance. Petersen & Rajan (1997) emphasize that the accessibility and malleability of trade credit financing confer distinct advantages in debt financing, thereby enhancing firm performance. Findings from Su's (2012) research indicate that the utilization of trade credit can attenuate operational costs and augment profit margins.

In summary, based on the analysis of the interaction between supply chain concentration and strategic deviation, trade credit financing, and enterprise performance, it can be found that changes in supply chain concentration and strategic deviation will affect the amount of trade credit financing obtained by enterprises, thereby affecting

enterprise performance. Therefore, this study proposes that trade credit financing is a mediating variable between supply chain concentration, strategic deviation, and firm performance. Therefore, the hypotheses are as follows:

H6a: Supplier concentration affects firms' operating performance through trade credit financing from suppliers.

H6b: Supplier concentration affects firms' financial performance through trade credit financing from suppliers.

H6c: Customer concentration affects firms' operating performance through trade credit financing from customers.

H6d: Customer concentration affects firms' financial performance through trade credit financing from customers.

H6e: Strategic deviation affects firms' operating performance through trade credit financing from suppliers.

H6f: Strategic deviation affects firms' financial performance through trade credit financing from suppliers.

2.5 Research on Financing Constraints

2.5.1 Measurement of Financing Constraints

Myers & Majluf (1984) proposed that financing constraints are manifested as a difference between the internal cost of capital and the external cost of capital of a firm. Fazzari et al. (1988) first defined financing constraints as the shortcomings of the capital market, which result in a difference in the cost of internal and external financing when a firm seeks financing, causing the firm to rely more on internal retained earnings and thus increasing the external financing constraint.

Kaplan & Zingales (1997) also provided a similar definition of financing constraints, stating that a firm experiences such constraints when there is a disparity between the cost of internal and external financing. In other words, when the cost of external financing is considerably higher than that of internal financing, a firm is considered to have financing constraints. Similarly, Silva & Carreira (2012) perceived financing constraints as a phenomenon in which a firm's financing needs cannot be adequately met due to a scarcity of external financing. Given the imperfections in the

Chinese capital market and the prevailing information asymmetry between firms and external investors, the difference between internal and external financing costs for firms tends to be substantial. Therefore, this study adopts Kaplan & Zingales (1997) definition of financing constraints, which acknowledges the existence of such constraints when the cost of external financing significantly exceeds that of internal financing.

There are three main types of metrics used to measure financing constraints: cash flow sensitivity models, single financial metrics, and constructed financing constraint metrics. The cash flow sensitivity model was initially proposed by Fazzari (1988), who highlighted the significant relationship between a firm's level of financing constraints and its internal cash flow. According to this model, the higher the level of financing constraints, the more reliant the firm becomes on internal cash flow, leading to the phenomenon of cash flow sensitivity. Almeida et al. (2004), in their study utilizing Chinese capital market data, also supported the use of cash-cash flow sensitivity as a basis for testing the financing constraint hypothesis. Moyen (2004) argued that the investment-cash flow sensitivity model serves as a more appropriate measure of a firm's level of financing constraints when the firm faces a highly challenging financial situation with no internal funds available for investing in new projects. However, it's important to note that not all firms in the capital market encounter difficulties in external financing, making it crucial to consider different scenarios for accurate measurement.

The financing constraint of a firm is affected by various types of financial indicators of the firm, so some scholars use such as firm size, debt rating, interest coverage multiple, dividend payout ratio, etc. when studying financial indicators. Li & Hu (2016) utilized a single financing constraint indicator, SFCI, calculated as the ratio of the change in real investment to the logarithm of Tobin's Q. A lower SFCI indicates a higher level of financing constraints faced by the firm. Wang (2009) used the nature of the firm's property rights as a measure of the degree of financing constraints.

Methods for measuring financing constraints primarily include the KZ index, WW index, and SA index (Kaplan & Zingales, 1997; Almeida et al., 2004; Whited & Wu, 2006; Hadlock & Pierce, 2010). These indices are commonly employed to construct indicators for financing constraints using multiple regression models.

The KZ index, introduced by Kaplan & Zingales (1997), utilizes five factors (net cash flow from operations, cash holdings, cash payout level, level of debt, and growth) as proxies to represent financing constraints. Through regression analysis, they constructed a composite index (KZ index) to measure the extent of financing constraints. Subsequently, this approach has been widely adopted in studies related to financing constraints (Almeida et al., 2004).

This study draws on Kaplan & Zingales (1997) and Wei et al. (2014) to construct a KZ index to measure the degree of financing constraints of a sample of Chinese listed manufacturing firms. Specifically, the KZ index was constructed according to the following steps:

1) Each year of the sample is categorised by net cash flow from operations/total assets in the previous period (kz1), cash dividends/total assets in the previous period (kz2), cash holdings/total assets in the previous period (kz3), gearing ratio (kz4) and Tobin's Q (kz5). 1 if kz1 is below the median, 0 otherwise; 1 if kz2 is below the median, 0 otherwise; 1 if kz3 is below the median, 0 otherwise; 1 if kz4 is above the median, 0 otherwise; 1 if kz5 is above the median, 0 otherwise.

2) Calculate the KZ index such that KZ = kz1 + kz2 + kz3 + kz4 + kz5.

3) Ordered Logistic Regression was used to regress the KZ index as the dependent variable on kz1 to kz5, and the regression coefficients of each variable were estimated.

4) Using the estimated results of the above regression model, we can calculate the KZ index of the degree of financing constraint for each listed company. A larger KZ index means a higher degree of financing constraint faced by the listed company.

2.5.2 Supply Chain Concentration and Financing Constraints

The study on the impact of supply chain relationships on financing constraints has relationship focuses on the impact of supply chain concentration on the cost of debt capital and the cost of equity capital of the firm, respectively.

The study of the impact of supply chain concentration on the cost of debt capital. Xu & Wang (2017) argued that there was a significant positive relationship between customer concentration and debt maturity structure, and the more highly concentrated a firm's customers are, the more willing it is to adopt long-term debt financing. At the same

time, the relationship between the firm and its customers makes its preference for debt maturity structure change and the governance role of debt maturity structure is reversed. Kang (2016) explored the link between customer concentration and the cost of debt, using the firm's level of risk-taking as a mediating bridge, and found through empirical research that the cost of debt rises after a firm's customers reach a certain concentration, and that the relationship is more significant in private firms than in state-owned firms, after which the level of risk-taking is measured through the volatility of the firm's earnings, ultimately concluding that risk-taking in customer concentration has a mediating role in the effect of concentration on the cost of debt financing. Wang et al. (2016) used a combination of theoretical and empirical evidence to explore the effect of a company's supply chain concentration on bank borrowing, ultimately concluding that a high concentration of suppliers and customers will allow banks to obtain its spillover effect on the identification of information about the company, helping to mitigate the asymmetric information that exists between the company and the bank, thus allowing the company's ability to obtain bank borrowing to increase the company's ability to obtain bank loans increases, both in terms of the amount of all loans available and the amount of long- and short-term loans. Moreover, when the bargaining level of the company rises, a certain concentration of suppliers and customers contributes to a better level of borrowing. From the perspective of supply chain management, Zhang (2017) investigated whether the concentration of the supply chain can impact the cost of debt capital by initially influencing operational risk. The study ultimately concluded that the concentration of the company's supply chain was significantly and positively related to the cost of debt capital, with a significant positive moderating effect of the degree of financial development in the region where the company was located. Additionally, Wang (2017) argued that customer concentration leads to an increase in the credit spreads of bonds, implying that customer concentration primarily poses risks to corporate bond investors. Moreover, the concentration of customers is more expressed as risk when the risk faced by customer relationships or commercial credit is even higher, and the risk faced by the bond issuing company itself leads to an increase in the risk brought by the concentration of customers. The higher the concentration of a company's customers, the higher the expected return risk as well as the cash flow risk,

which suggested that customer concentration does represent risk for investors in corporate bonds.

Research on the impact of supply chain concentration on the cost of equity capital is still relatively limited, and no consistent conclusion has been reached. Chen et al. (2015) argued that when the environment in which a company operates is less uncertain, a higher degree of customer concentration leads to lower equity financing costs. This suggests that customer concentration contributes to supply chain integration, enhancing a firm's operations and risk reduction. This positive signal to the market results in lower equity financing costs. However, the effect of customer concentration on the cost of equity varies due to differences in market conditions among firms.

In contrast, Zhou & Wang (2017) reached an opposite conclusion, stating that higher customer concentration increases the cost of equity capital. They also found that the intensity of competition in the product market positively moderates this relationship. When competition is more intense, customer concentration leads to higher risks, driving up the cost of equity. Bi et al. (2018) arrived at a similar conclusion, asserting that customer concentration is significantly and positively related to the cost of equity. They argued that customer concentration increases both systematic and unsystematic risks, elevating operational risk and, consequently, the cost of equity financing. Additionally, the risk of customer churn and credit risk positively moderate the negative impact of customer concentration on the cost of equity.

In summary, research on the role of supplier and customer concentration in financing constraints is relatively limited, with a primary focus on customer concentration. The findings in this area are inconsistent, and more research is needed to provide a clearer understanding of these relationships.

2.5.3 Strategic Deviation and Financing Constraints

The strategic positioning of a company directly determines the structure of resource allocation. A differentiated strategy increases the level of information asymmetry within the investor and the company, and investors and creditors will be more cautious in making investment decisions in the company, so investors and creditors tend to reduce the risk that may result from strategic differences by offering higher rates of return on dividends and interest or by reducing the amount of investment.

Implementing a differentiation strategy requires companies to make substantial investments in research and development, market expansion, and other areas. However, this approach comes with higher business risks, leading to increased financing constraints for companies. Deephouse (1999) observed that firms adopting a non-conventional industry strategy model often face challenges in obtaining external financing. Differentiation strategies are more likely to be met with skepticism and scrutiny from external investors, suppliers, and customers who may have difficulty understanding the firm's business direction. In such cases, these stakeholders tend to be cautious about engaging with the firm, resulting in reduced access to funds and higher financing costs.

Li & Shi (2016) pointed out that banks consider non-financial information, such as strategic differences announced by firms, when making lending decisions. When there is greater strategic deviation, it often leads to higher interest rates on bank loans, and banks are more inclined to offer short-term, small loans to firms. Similarly, Wang et al. (2017) argued that firms with higher strategic deviation face greater demands from investors for higher payoffs and returns on investment. Xie et al. (2018) highlighted that as a firm's strategic deviation increases, so does the potential for surplus manipulation, which results in higher information risk for investors and increased financing costs. Sheng et al. (2018) contended that strategic deviation exacerbates the risks and financing costs faced by firms, while also slowing down the adjustment process of their capital structure, which is not conducive to optimizing corporate financial structure.

2.5.4 The Impact of Financing Constraints on Trade Credit Financing

The existing literature offers varying conclusions regarding the impact of financing constraints on trade credit financing. One perspective suggests that financing constraints have a positive influence on trade credit financing. Petersen & Rajan (1997) observed that firms facing financing constraints seek alternative financing sources, such as trade credit. Niskanen & Niskanen (2006) conducted an empirical study on Finnish firms and found that those with financing constraints may resort to trade credit as an alternative means of financing. Similarly, Molina & Preve (2012), who analyzed data on trade credit financing from 1978 to 2000, discovered that firms experiencing financing constraints tend to rely more on trade credit for short-term financing, especially larger firms. Martínez-Sola et al. (2013) and Shi et al. (2020) reported similar findings. On the

other hand, Tang & Andrea (2019) explored the relationship between accounts receivable and short-term bank borrowing for SMEs during the period of 2008-2016. Their empirical findings indicated that cash-strapped exporting SMEs turn to trade credit financing, which can act as a substitute for traditional bank borrowing.

Other points raised objections to the above conclusion. Love et al. (2007) employed data from a multi-country sample and found that financial crises can significantly affect trade credit financing, especially when firms face financing constraints. They tend to reduce the provision of trade credit financing. Wang & Xi (2013) identified a non-linear relationship between financing constraints and trade credit financing, and this relationship is influenced by firm size.

Drawing on theories of information asymmetry and resource dependency, the degree of supply chain concentration and strategic deviation in a company bears influence on the magnitude of trade credit financing. The intensity of financing constraints encountered by companies will impinge on the aforementioned relationship. When companies endure lower financing constraint pressures, they exhibit a greater reliance on internal financing, display less motivation to pursue external financing, and consequently, exhibit less incentive to acquire additional trade credit financing from customers and suppliers. Conversely, when companies are subjected to greater financing constraints, they exhibit a stronger reliance on trade credit for financing. Therefore, this study argues that financing constraints play a moderating role in the impact of supply chain concentration and strategic deviation on trade credit financing. Thus, the hypotheses are as follows:

H7a: Financing constraints moderate the relationship between supplier concentration and trade credit financing from suppliers.

H7b: Financing constraints moderate the relationship between customer concentration and trade credit financing from customers.

H7c: Financing constraints moderate the relationship between strategic deviation and trade credit financing from suppliers.

H7d: Financing constraints moderate the relationship between strategic deviation and trade credit financing from customers.

Integrating Hypotheses 6 and 7, the present study suggests that trade credit financing exerts a moderating influence on its intermediary role, thereby constituting a moderated mediation effect. Enterprises experiencing high financing constraints, when confronted with elevated supply chain concentration and strategic deviation, display a pronounced propensity for external financing, facilitating their procurement of more extensive trade credit financing. Under these conditions, the likelihood that supply chain concentration and strategic deviation impact firm performance via trade credit financing escalates. In contrast, enterprises grappling with low financing constraints exhibit a tendency to rely more heavily on internal financing, and with a constant level of supply chain concentration and strategic deviation, their motivation to secure trade credit financing may not be as potent. Therefore, this study argues that financing constraints moderate the mediating role of trade credit financing. Thus, the hypotheses are as follows:

H8a: Financing constraints moderate the mediating effect of supplier trade credit financing on the relationship between supplier concentration and firm operational performance.

H8b: Financing constraints moderate the mediating effect of supplier trade credit financing on the relationship between supplier concentration and firm financial performance.

H8c: Financing constraints moderate the mediating effect of customer trade credit financing on the relationship between customer concentration and firm operational performance.

H8d: Financing constraints moderate the mediating effect of customer trade credit financing on the relationship between customer concentration and firm financial performance.

H8e: Financing constraints moderate the mediating effect of supplier trade credit financing on the relationship between strategic deviation and firm operational performance.

H8f: Financing constraints moderate the mediating effect of supplier trade credit financing on the relationship between strategic deviation and firm financial performance.

2.6 Literature on Control Variables

Some other factors may influence the relationship between supply chain concentration, strategic deviation, trade credit financing, and firm performance. In previous studies on supply chain concentration and firm performance, many scholars have included firm size and leverage as control variables (Baysinger & Hoskisson, 1989; Fisman & Love, 2003; Ge & Qiu, 2007; Graves & Langowitz, 2006; Liao et al., 2016). According to Peterson & Rajan (1997), a phenomenon known as "size discrimination" exists in trade credit, whereby larger firms are more likely to secure trade credit financing. Larger firms tend to have a stronger market position (Baysinger & Hoskisson, 1989), more extensive resources than small firms, and their managerial decisions are more likely to have a significant impact on performance (Graves & Langowitz, 2006; Liao et al., 2016). Additionally, large firms typically possess ample capital, abundant human resources, various financing channels, and higher risk tolerance. They may also enjoy a certain level of market dominance, which makes it easier for them to achieve above-average profits (Sasidharan et al., 2015).

Financial leverage also affects different management practices and firm performance. Firms with low debt ratios are in good financial condition and are not prone to financial difficulties, which is an important reference for suppliers and customers to make credit decisions (Zhou et al., 2019; Zhang & Sheng, 2021). In addition, firms with high debt ratios may have greater demand for trade credit financing (Seifert et al., 2013). Therefore, in this study, the natural logarithm of the firm's total assets is used to measure firm size. The financial leverage of the firm is measured by the debt-equity ratio.

2.7 Relevant Theories

2.7.1 Theory of Information Asymmetry

The core view of information asymmetry theory is that in the process of market transaction, due to the different ability of economic actors to grasp information and obtain information, the amount of information and the degree of information related to the transaction that both parties can obtain is unequal and unbalanced, in which the party who has more information is more advantageous than the party who has less information (Akerlof, 1970; Myers & Majluf, 1984; Singh & Agarwal, 2002).

There are two specific forms of information asymmetry. First, there is information asymmetry between owners and managers. Owners are usually not directly involved in management, and they need to rely on managers' disclosure information to understand the business situation. Second, there is also information asymmetry between the enterprise and its external stakeholders. External stakeholders, including investors, creditors, government, suppliers, customers, etc., usually do not have a deep understanding of the enterprise and can only be understood indirectly through the information disclosed by the enterprise. Therefore, the owners of the company who are not involved in the management are at an information disadvantage compared to the managers and the external stakeholders are at an information disadvantage compared to the company.

Trade credit financing is a financing method provided by upstream and downstream of the supply chain. Compared with bank loans, the counterparties know each other better, are more likely to identify the situation of solvency and profitability of enterprises, and grant more generous commercial credit terms to better-run enterprises. These trading partners have an information advantage over banks, which makes them more willing to provide financing to firms than banks. However, information asymmetry also exists between the supply and demand sides of trade credit, with the occupier of funds usually having an information advantage over the supplier of funds. In this case, the capital user may act against the interests of the creditor for the sake of maximizing its interests, while the creditor will take measures such as improving credit terms in order to mitigate the risk caused by the information disadvantage.

2.7.2 Transaction Cost Theory

The concept of transaction costs was first introduced by Coase (1937). He argued that there are costs associated with trading in the market and that the organization formed through institutional creation and trading arrangements is designed to reduce these costs. Dahlman (1979) further refined the content of transaction activities and concluded that transaction costs mainly include: information search costs, contract costs, decision and negotiation costs, supervision costs, switching costs and execution costs, explaining the basic connotations and patterns of transaction costs. Simply put, transaction costs are the costs of negotiating terms, searching for information, and conducting transactions

when implementing transaction activities.

Williamson (1975) argued that transaction costs arise from market failures caused by the interaction of trading environment factors and human factors. He measured the factors affecting transaction costs in three dimensions: dedicated investment, transaction frequency, and transaction uncertainty. Earmarked investment can be understood as the investment behavior of a trading entity with a specific counterparty, and the value of such investment will be severely depreciated if it is changed to a different use or transferred to a third party. Earmarked investments may have both positive and negative economic consequences. On the one hand, the trader can obtain a higher earmarked return through earmarked investments; on the other hand, earmarked investments reduce their value in other uses and increase the risk of opportunism of the investor. Trading frequency means the number of transactions, the more frequent the transactions, the greater the transaction cost, and the frequency of transactions is linearly related to the transaction cost. Trading uncertainty means that there is risk in trading. Due to the complexity of the market environment, the unequal status and information asymmetry between the parties to the transaction, the risk of performance increases and the cost of performance and bargaining increases. Williamson (1975) believed that the key drivers of management decisions in inter-organizational relationships are minimizing transaction costs and maximizing transaction efficiency.

Hart & Moore (1990) argued that in complex and volatile markets, contracts were always incomplete, and because of this incompleteness, firms can be put in a difficult situation by dedicated investments, and the firm's partners may break the contract at any time. Firms can take certain measures to protect their interests, one way is through integration, in order to reduce the adversarial relationship between the two parties, the implementation of mergers and acquisitions upstream and downstream of the firm; another way is to enter into reciprocal purchase agreements, where the parties to the transaction exchange collateral with each other, or enter into partial interest agreements. Williamson (1991) found that individuals differ in characteristics, governance structure, and degree of competition. Complementarity among individuals can be achieved through firms, and the formation of firms is one way to maximize economies of scale.

Clemons (1993) argued that in the transaction process of supply chain parties, transaction costs include cooperation costs and transaction risks. Cooperation cost refers to the cost of exchanging and integrating information in the decision making process, for example, in the relationship between customers and suppliers, the cooperation cost mainly includes the cost of obtaining information about the price, cost, and demand of the traded products; transaction risk refers to the risk caused by information asymmetry and the possibility of the other party shirking its responsibility, for example, the supplier may adopt a concealed way to provide customers with crude For example, the supplier may conceal and provide customers with shoddy products.

According to transaction cost theory, supply chain concentration can achieve supply chain integration, information sharing and dedicated investment. This can have an impact on trade credit financing and business performance of each party.

2.7.3 Resource Dependency Theory

Resource dependency theory believes that organizations cannot survive and develop without the resources provided by the surrounding environment, and must interact and interdepend with the surrounding environment to achieve their goals (Handfield,1993). Therefore, firms need to exchange with other organizations in the environment to access resources (Pfeffer & Salancik, 2003). Its main points are as follows: first, resource dependence between organizations leads to external control of one organization over another, which will have an impact on the internal power distribution of the organization and ensure the normal operation of the organization requires a variety of heterogeneous resources, which cannot be produced by the organization itself; second, external constraints and internal power arrangements build the conditions for the operation of the organization, which will lead to the maintenance of the internal autonomy of the organization with the freedom from external dependence behavior. The important value of resource dependence theory is that it explains the interactions and interdependencies between organizations and their surroundings. It provides a theoretical basis for the study of resource dependence and use strategies in the production and financial decision-making process.

The distinctive view of resource dependence theory is that by examining how organizations can transform their environment by means of association, merger, lobbying

and governance, it suggests that organizations are no longer recipients of adaptation to the environment for survival and growth, but have to adapt the environment to their own development. The theory emphasizes not only the influence on the environment, but also the interrelationship between organizations. In real organizational activities, organizations control environmental resources mainly through organizational network behavior and organizational merger strategies. For example, in order to reduce the dependence on other organizations, the organization will integrate vertically; achieve horizontal development by absorbing competitors to reduce the uncertainty in competition; or expand into more fields through diversified business strategies to avoid over-dependence on the core organizations in a certain field, etc. Some scholars argue that resource dependence theory overemphasizes the controlling role of power and ignores institutional culture and efficiency factors.

Resource dependence theory focuses on the idea of interdependence because it is impossible for anyone firm alone to have all the resources to accomplish the firm's objectives and to complement the strengths of other firms to obtain the required resources (Handfield, 1993). Firms in the supply chain need to be interdependent and cooperate with each other (Dubois et al., 2008). The cooperation and coordination of companies in the supply chain is both an opportunity and a challenge for companies, which can not only increase their competitiveness (Chen et al., 2004), but also help them to better control their environment, improve the accuracy of forecasting, and ensure the stability of their business management activities (Bresser & Harl, 1986). Under the supply chain management, enterprises should not only maintain collaborative relationships with customers and suppliers, but also ensure that the supply chain is in a benign mechanism of sharing benefits with each other (Dyer, 1998), as strategic partners of enterprises customers and suppliers could provide enterprises with competitive advantages and other social resources, such as integrity, status, etc.

Specifically, a company is an open organization that cannot provide all the resources for survival and growth on its own and must exchange resources with external environmental factors, such as customers, suppliers, regulators and competitors. Among them, customers and suppliers are important stakeholders. Customer concentration and supplier concentration represent important characteristics of customer and supplier

relationships; they refer to the degree of dispersion or concentration of customers and suppliers. A higher concentration means that the company depends on a few large customers and suppliers with higher importance; a lower concentration means that customers and suppliers are more dispersed and there are fewer core customers and suppliers. In a resource-dependent relationship, there is power inequality between business partners. For example, when customers have strong bargaining power and alternative suppliers exist, firms have less freedom to choose the most profitable contract design and are more dependent on their customers. Customers with strong bargaining power can influence prices by suppressing demand information, potentially reducing the firm's profitability and thus affecting its business performance.

2.7.4 The pecking Order Theory

The pecking order theory suggests that firms generally follow a particular financing pattern when financing investment projects. Myers (1984) modified and improved the pecking order theory: (1) when financing promising investment projects, companies often exhibit a tendency towards risk aversion and preference, typically avoiding financing through high-risk equity or debt instruments. (2) In order to achieve the highest possible return on investment through internal financing, companies set a target dividend payout ratio in advance to match it. (3) Only after ensuring the safety of debt and the absence of financial distress will a company plan to cover the shortage of investment funds through external debt financing. (4) Since the target dividend payout ratio is sticky, when internal cash flow is depleted or cannot meet investment needs, firms will give priority to low-risk and safer debt financing, followed by hybrid securities, and finally consider issuing higher-risk equity to carry out financing behavior. The modified pecking order theory provides a more reasonable theoretical basis for explaining the empirical evidence of the financing behavior of firms in reality.

Companies are generally financed by internal or external financing, or both. Internal financing includes cash holdings or retained earnings, while external financing includes debt financing and equity financing. Aghion (2004) pointed out that the risk averse behavior of managers makes them divert funds from debt financing to other risk-free investment projects. Also, the increased cost of external financing can make it difficult for firms to obtain sufficient investment funds, and thus firms face severe

financing constraints (Kerr & Nanda, 2015). Therefore, access to more trade credit financing would alleviate firms' financial woes.

2.8 Chapter Summary

This chapter reviews the literature on supply chain concentration, strategic deviation, trade credit financing, firm performance and financing constraints, and summarizes the main findings and limitations of the previous literature.

From the perspective of supply chain concentration, previous literature mainly studies customer concentration or supplier concentration perspectives separately, while not many study the two together. A close supply chain relationship can reduce communication costs, help firms make more rational purchasing, manufacturing and sales decisions, and reduce inventory levels, e.g. a close customer relationship can help improve customer satisfaction, maintain customer loyalty, increase the firm's market share, and improve the firm's performance and the performance of the entire supply chain. On the other hand, the increase of supplier and customer concentration will increase the dependence of enterprises on major suppliers and customers, reduce the negotiation power of enterprises, and enterprises may be in a weak position in price negotiations as well as trade credit financing negotiations, which affects the performance of enterprises. In addition, trade credit financing is a mediating variable of supply chain relationships affecting firm value, and firms influence trade credit financing through supply chain cooperation, which in turn affects firm performance. This study combines the two and empirically investigates their effects on trade credit financing and firm performance from both the supplier's perspective and the customer's perspective.

In terms of the interaction between trade credit financing and supply chain concentration, previous studies have found that the main motives for suppliers and customers to provide trade credit financing to firms include financing motive, marketing motive, reducing transaction cost motive, achieving price discrimination motive, and quality assurance motive, and trade credit financing will be influenced by the negotiation power of both sides of the transaction. Under the financing motive, the supplier will allow the enterprise to defer payment and the customer will make timely payment to the enterprise to alleviate the enterprise's financing constraints; under the marketing motive,

trade credit plays the same role as advertising to attract and retain customers and increase the supplier's sales share; under the transaction cost reduction motive, trade credit can be used for regular settlement, which helps both sides of the transaction to better manage funds and reduce transaction costs. Under the price discrimination motive, trade credit financing can be used as an identification mechanism to help suppliers and customers identify the business conditions of enterprises and can reduce the opportunistic behavior of both sides of the transaction; under the quality assurance motive, customers have a long enough time to check the quality of products during the trade credit period, and trade credit is a signal for suppliers to transmit the quality of products to customers. In addition, the bargaining power of both sides of the transaction also affects firms' trade credit financing, and the party with greater bargaining power is more likely to obtain more trade credit financing. This study puts suppliers, customers and firms into the same research framework to investigate the impact of supply chain concentration on trade credit financing.

From the perspective of financing constraints, previous studies have focused on the impact of supply chain concentration on the cost of debt capital and the cost of equity capital of the firm, respectively. The main view is that the concentration of supply chain is significantly and positively related to the cost of debt capital. Its impact on the cost of equity capital has been studied mainly in terms of customer concentration. Financing constraints play a positive moderating role in customer concentration affecting the cost of equity capital. There are also two different views on the impact of financing constraints on corporate performance: one view, from the theory of optimal capital structure, argues that financing constraints prevent firms from effectively choosing financing methods according to their own circumstances, making it difficult for firms to achieve optimal capital structure and inhibiting the improvement of firm performance; the other, from the perspective of agency cost theory, argues that the existence of financing constraints makes corporate management carefully evaluate investment projects and effectively avoid The other one, from the perspective of agency cost theory, argues that the existence of financing constraints makes the management of enterprises evaluate investment projects carefully and effectively avoid adverse selection problems to improve the efficiency of capital use, which in turn improves enterprise performance. In addition, the use of trade

credit financing by firms can reduce transaction costs and alleviate financing constraints. This study introduces a moderating model to test the moderating role of financing constraints in the effect of supply chain concentration on trade credit financing and firm performance.

CHAPTER 3
RESEARCH METHODOLOGY

3.1 Introduction

The research methodology of this study is demonstrated in this chapter. Firstly, the hypothesis structural model of the study is established based on theoretical analysis and literature review. Secondly, the research variables, population, and sample are incorporated into the research design. Thirdly, data collection is detailed. Fourthly, data analysis methods encompass descriptive statistics, multiple regression, mediation analysis, and moderation analysis techniques. Finally, the model is tested against the hypotheses to draw conclusions.

3.2 Hypothesized Structural Model

Based on the conceptual framework and assumptions of this study, a hypothesis structure model was developed for this study (Figure 3.1).

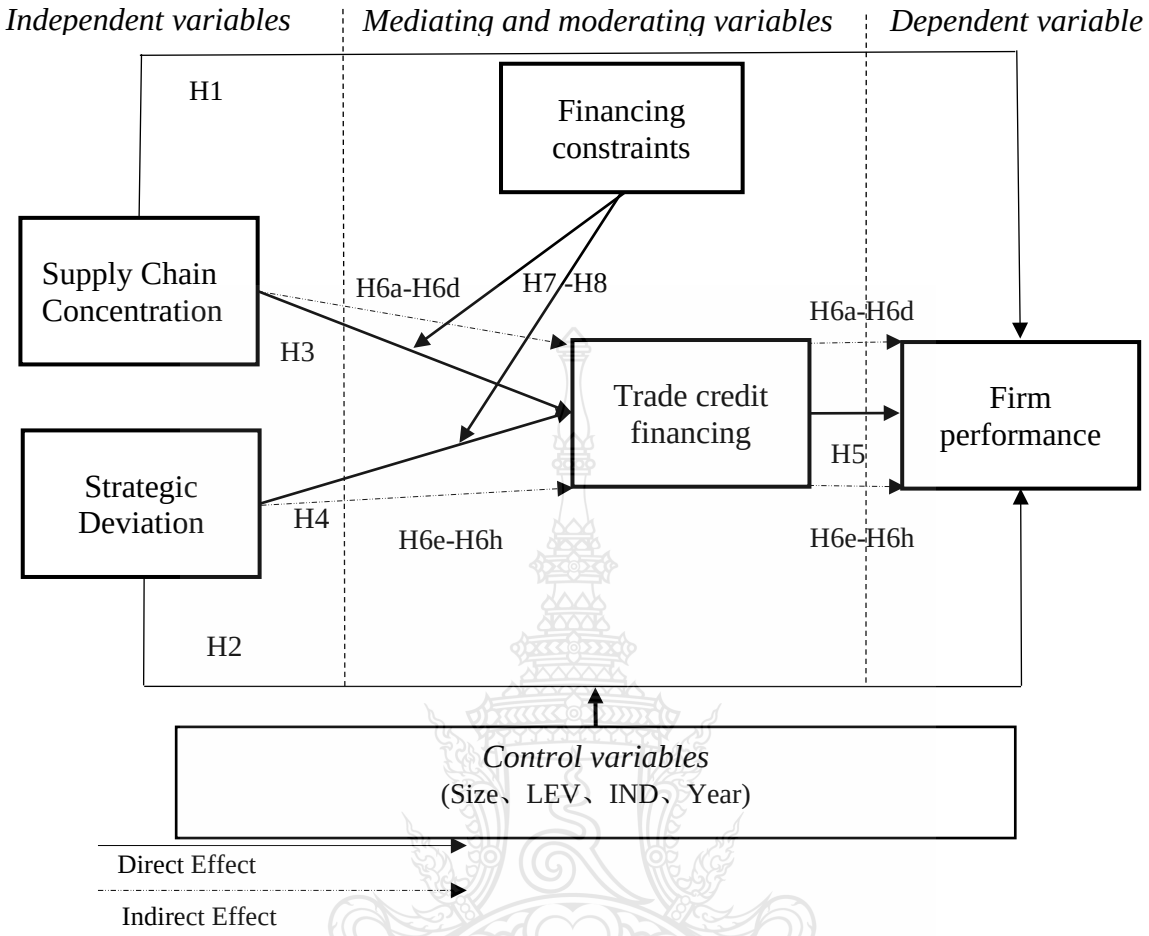

Figure 3.1 The hypothesized structural model

3.3 Research Design

This study aims to investigate the influence, pathways, and mechanisms of supply chain concentration and strategic deviation on trade credit financing and firm performance. Furthermore, this research explores the moderating role of financing constraints in this relationship. The data for this study was derived from publicly traded manufacturing companies in China. Financial information, supply chain transaction data, and operational details were disclosed in the annual reports of these listed companies. Therefore, this study collected secondary data from the annual reports of Chinese manufacturing companies and conducted data processing and statistical analysis.

This study employed a quantitative research approach, gathering data from publicly traded Chinese manufacturing companies from 2013 to 2020. The collected data encompassed company profiles, supply chain concentration, strategic deviations, trade

credit financing, corporate performance, and financing constraints. Drawing upon resource dependency theory, transaction cost theory, information asymmetry theory, and pecking order theory, these relationships were incorporated into the research framework. Subsequently, quantitative analytical methods were employed for statistical analysis.

3.3.1 Variables and Measurements

1) Independent variable

In this study, two independent variables were selected: Supply chain concentration and strategic deviation. Supply chain concentration pertains to the number of partners in the upstream and downstream of the supply chain, as well as the level of business concentration. This includes both supplier concentration and customer concentration (Kwak & Kim, 2019; Zhang et al., 2020). On the other hand, strategic deviation refers to the extent to which a firm's strategy deviates from the conventional strategic pattern within the industry (Finkelstein & Hambrick, 1990; Geletkanycz & Hambrick, 1997; Carpenter, 2000; Tang et al., 2011). Detailed information and measurements of these variables are provided in Table 3.1.

2) Dependent variable

Firm performance was used as the dependent variable in this study. The firm's operating performance is measured in terms of gross profit margins (Maury & Pajuste, 2005; Kasturi & Upasana, 2020). It is calculated as the revenue from main operations minus the cost of main operations, divided by revenue from main operations. This choice is based on the focus of the study, which is to examine the impact of supplier and customer concentration on trade credit financing and firm performance. Supplier concentration is measured by the top five supplier purchasing ratio, often disclosed in the operating cost column, while the top five customer sales ratio is disclosed in the operating revenue column. Therefore, it is evident that trade credit financing has a greater influence on the firm's operating performance. Thus, this study adopts gross profit margin (GPM) as a measure of the company's operational performance. On the other hand, the financial performance of a company is measured by the return on assets (ROA) (Uotila et al., 2009; Wu et al., 2012; Park et al., 2022). ROA represents the ratio of the firm's profit to its average assets. The specific information and measurements of these variables are provided in Table 3.1.

3) Mediating variables

Trade credit financing was considered a mediating variable in this study. It refers to the common credit relationships that are formed through deferred payments or advance payments in normal business activities and commodity transactions, both upstream and downstream of the firm. Since firms engage in commercial credit relationships with both their customers and suppliers in the supply chain, this study divides trade credit financing into two categories: trade credit financing in supplier transactions (TCs) and trade credit financing in customer transactions (TCr). Specifically, these include: a. Trade credit financing (TCs): This represents the trade credit that firms receive from their suppliers (Seifert et al., 2013; Lee et al., 2018). b. Trade credit financing (TCr): This represents the trade credit that firms receive from their customers (Li & Liu, 2016; Dou et al., 2019). The specific details and measurements of these variables are outlined in Table 3.1.

4) Moderating variable

Financing constraints were used as a moderating variable for the study. Various methods can be employed to measure financing constraints, such as the KZ index, WW index, SA index, and single financial indicators, among others. In particular, the KZ index is a composite index constructed through a regression analysis of five factors: net cash flow from operating activities, cash holdings, cash payment level, debt level, and growth. This approach is widely utilized in the examination of financing constraints (Almeida et al., 2004). For the purpose of this study, the KZ index will be constructed to gauge the extent of financing constraints among Chinese manufacturing listed companies (Kaplan & Zingales, 1997; Wei et al., 2014). Specific details and measurements of these variables can be found in Table 3.1.

5) Control variable

In this study, based on the studies of Peterson & Rajan (1997), Fisman & Love(2003), Ge & Qiu(2007), Zhou et al. (2019), Zhang & Sheng(2021), the following variables were selected as control variables. To control its influence on trade credit financing and enterprise performance. The scale of enterprise (SIZE), the leverage ratio (LEV), Industry (IND), YEAR. Where the natural logarithmic measure of the size of the firm's assets was taken and denoted by aSIZE. Six industry dummy variables and eight

year dummy variables were included to control for the effect of industry and year on the relationship between the variables. The specific information and measurements of the variables are shown in Table 3.1.

Table 3.1 Definition and measurement of variables

Variable	Symbol	Measurement	Sources
Independent variables			
Supplier Concentration	SC	Top five suppliers purchase amount/All purchase amount	Kähkönen et al.,(2015); Campello & Gao ,(2017)
Customer Concentration	CC	Top five customers sales amount/All sales amount	Huiet al., (2018); Zhou et al.,(2019)
Strategic deviation	SD	Average of the standardised absolute values of the six dimensional strategic metrics	Carpenter,(2000）;Tang et al.(2011)
Dependent variables			
Firm performance	GPM	Gross profit margin = (operating revenue - operating costs) / operating revenue	Maury &Pajuste (2005); Kasturi & Upasana (2020)
	ROA	Net profit after tax / Total assets	Wu et al., (2012); Uotila et al., (2009); Park et al., (2022)
Mediating variables			
Trade credit financing from suppliers	TCs	(Accounts payable-Prepayment) / Cost of main operations	Seifert et al., (2013); Lee et al., (2018)
Trade credit financing from customers	TCr	(Receivables in advance-Accounts receivable) / Revenue from main business	Li & Liu, (2016); Dou et al., (2019)
Moderating variable			
Financing constraint	FC	Using the methodology of Kaplan & Zingales (1997), a regression model based on five financial indicators was used to estimate a KZ index representing the degree of financing constraints	Kaplan & Zingales (1997); Wei et al. , (2014)

Table 3.1 Definition and measurement of variables (Comt.)

Variable	Symbol	Measurement	Sources
Control variables			
Firm size	aSIZE	Natural logarithm of total assets at the end of the period (LNSize)	Peterson & Rajan (1997); Baysinger & Hoskisson (1989); Graves & Langowitz (2006); Liao et al., (2016) Sasidharan et al., (2015)
Financial Leverage	LEV	Year-end liabilities / Year-end assets	Zhou et al., (2019);Zhang & Sheng, (2021)
Industry	IND	Industry dummy variables (1-6)	
Year	YEAR	Year dummy variables (2013-2020)	

3.3.2 Population and Samples

This study aims to investigate the influence of supply chain concentration and strategic deviation on trade credit financing and performance within a sample of Chinese manufacturing firms listed on the stock exchange. Consequently, the sample of this research includes all listed companies within the Chinese manufacturing industry. Panel data of the listed companies in the manufacturing sector from the years 2013 to 2020 were collected for analysis, constituting an unbalanced panel data. The manufacturing industries listed on the Chinese stock market are presented in Table 3.2.

Table 3.2 All listed manufacturing companies in china

Number of industries/Companies	2013	2014	2015	2016	2017	2018	2019	2020
1. Leather, fur, feather and their products and footwear industry	5	5	6	6	6	6	6	10
2. Woodworking industry	7	7	5	8	9	8	8	7
3. Printing and recording media reproduction	6	6	6	10	11	11	13	14
4. Manufacture of sports and recreational goods	5	6	7	7	11	12	12	15
5. Fuel processing industry	12	12	11	15	16	16	16	17
6. Petroleum and chemical products industry	136	146	134	173	204	212	230	265
7. Pharmaceutical manufacturing industry	121	131	133	165	198	205	219	253

Table 3.2 All listed manufacturing companies in china (Cont.)

Number of industries/Companies	2013	2014	2015	2016	2017	2018	2019	2020
8. Computer and communications equipment manufacturing	180	188	188	244	298	316	355	419
9. Chemical fiber manufacturing	17	18	17	19	20	22	22	25
10. Non-ferrous metal smelting and processing industry	236	251	226	307	343	346	365	434
11. Equipment manufacturing industry	178	188	158	232	278	286	301	351
12. Electrical machinery and equipment manufacturing industry	127	138	130	166	192	201	219	245
13. Comprehensive utilization of waste resources	1	1	1	3	3	3	6	8
14. Other manufacturing	11	10	9	13	15	17	17	21
Total number of companies by year	1042	1107	1031	1368	1604	1661	1789	2084

This study selected six of China's 14 listed manufacturing industries as the final sample. The selected industries are petroleum and chemical products, pharmaceuticals, computer and telecommunications equipment, non-ferrous metal smelting and processing, machinery and equipment, and electrical machinery and equipment. There are several reasons for this selection. Firstly, the other nine industries have a relatively small number of enterprises, usually less than 30, resulting in an inadequate sample size for meaningful analysis. Secondly, the aforementioned six industries hold a crucial position in the national economy, directly reflecting the country’s productivity level, acting as core drivers of economic growth, and contributing significantly to the country's sustainable development and enterprise growth. Thirdly, these industries have clearly defined upstream and downstream supply chain relationships, where suppliers and customers exert a substantial influence on the manufacturing enterprises' production, operations, and overall management. Lastly, these industries consist of capital-intensive enterprises, providing a sufficient and robust sample size for analysis. Furthermore, the study excludes firms with missing variables and financial anomalies from the sample. Additionally, suspended and delisted firms are also excluded from the sample. After applying these exclusion criteria, a total of 7488 observations were obtained for the study. Specific information regarding the sample used in this research is presented in Table 3.3.

Table 3.3 Population and sampling

Description	2013	2014	2015	2016	2017	2018	2019	2020	Total
All manufacturing companies listed on Chinese stock exchanges (2013-2020)	1042	1107	1031	1368	1604	1661	1789	2084	11686
Excluded industries and companies:									
1. Leather, fur, feather and their products and footwear industry	5	5	6	6	6	6	6	10	50
2. Woodworking industry	7	7	5	8	9	8	8	7	59
3. Printing and recording media reproduction	6	6	6	10	11	11	13	14	77
4. Manufacture of sports and recreational goods	5	6	7	7	11	12	12	15	75
5. Fuel processing industry	12	12	11	15	16	16	16	17	115
6. Chemical fiber manufacturing	17	18	17	19	20	22	22	25	160
7. Comprehensive utilization of waste resources	1	1	1	3	3	3	6	8	26
8. Other manufacturing	11	10	9	13	15	17	17	21	113
9. Variables missing data companies	387	218	205	216	302	154	273	389	2144
10. Financially unusual companies	106	125	132	178	191	176	156	215	1279
11. Delisted and suspended companies	16	15	9	14	14	11	12	6	97
Final sampling	469	684	623	879	1003	1225	1248	1357	7488
Percentage (%)	45	61.80	60.40	64.30	62.50	73.80	69.80	65.10	64.08

3.4 Data Collection

This research gathered secondary data from six sectors of publicly listed Chinese manufacturing companies. Considering the availability of research data, this study collected all financial report data of listed manufacturing companies from 2013 to 2020. This is due to a significant change in China's accounting rules in 2012, when all listed companies were required to publish data on supply chain relationship transactions from 2013 onwards, prior to which there was a significant lack of data. In addition, China's economic and social development from 2013 to 2020 was relatively stable and less affected by factors such as disease, war and economic crisis on a global scale. Data indicators such as supply chain concentration and firm performance are mainly obtained

from the China CSMAR database. Trade credit financing and capital information of each firm was collated and obtained through financial statement data of listed companies, and financing constraint indicators were obtained through regressions by drawing on Kaplan & Zingales (1997) and Wei et al. (2014).

3.5 Data Analysis

In this study, quantitative analysis was applied to empirically test the data, including descriptive statistical analysis, univariate analysis, correlation analysis, mediating effect test, and multiple regression analysis.

3.5.1 Descriptive Statistical Analysis

Descriptive statistical analysis was used to describe the basic characteristics of the data in the study. This analysis uses analysis including sample size, mean, maximum, minimum, median and standard deviation to summarize the important characteristics of the data.

3.5.2 Univariate Analysis

The univariate analysis reflects fundamental information within the data sample, detailing the tendencies of centralization or dispersion within the sample data. This study conducted a grouped analysis based on the median to preliminarily identify the relationship between supply chain concentration, strategic deviation, performance, and trade credit financing.

3.5.3 Correlation Analysis

Correlation analysis was used to investigate the correlation between the main variables, the shape and direction of the correlation presented and the closeness of the correlation.

3.5.4 Mediating Effect Test

The mediating effect test was used to analyze the process and mechanism of action of the independent variable on the dependent variable. Drawing on the mediation effect test procedures of Judd & Kenny (1981), Baron & Kenny (1986), Hayes & Preacher (2010) and Wen & Ye (2014), This study tested whether there is a mediation effect of trade credit financing in supply chain concentration and strategic deviation that affects firm performance.

3.5.5 Multiple Regression Analysis

This study employed multiple regression analysis to establish quantitative relationships among various variables in a linear statistical model. This method facilitates the analysis of sample data, enabling an investigation into the impact of supply chain concentration and strategic deviation on trade credit financing and company performance. Additionally, this research incorporated financial constraints into the regression model to examine whether they can moderate the effects of supply chain concentration and strategic deviation on trade credit financing, as well as the moderated mediation effects.

3.6 Hypotheses and Model Testing

3.6.1 Model 1

H1: Supply chain concentration has an impact on firm performance.

The following specification were used for the relationship between supply chain concentration and firm performance.

$$\mathrm{GPM} = \alpha_{10} + \alpha_{11} SC + \alpha_{12} aSIZE + \alpha_{13} LEV + Year + Ind + \varepsilon_1 \quad (1\text{-}1)$$

$$\mathrm{ROA} = \alpha_{20} + \alpha_{21} SC + \alpha_{22} aSIZE + \alpha_{23} LEV + Year + Ind + \varepsilon_2 \quad (1\text{-}2)$$

$$\mathrm{GPM} = \alpha_{30} + \alpha_{31} CC + \alpha_{32} aSIZE + \alpha_{33} LEV + Year + Ind + \varepsilon_3 \quad (1\text{-}3)$$

$$\mathrm{ROA} = \alpha_{40} + \alpha_{41} CC + \alpha_{42} aSIZE + \alpha_{43} LEV + Year + Ind + \varepsilon_4 \quad (1\text{-}4)$$

To test each of the four hypotheses H1a-H1d, the above models (1)-(4) were used. In the above equation, GPM and ROA represents the dependent variable. GPM represents the company's operating performance and ROA represents the company's financial performance. CC represents the degree of customer concentration, SC represents the degree of supplier concentration, Year and Ind represent the dummy variables for year and industry respectively, α_{10} to α_{43} were regression coefficients, ε represents a random disturbance term.

3.6.2 Model 2

H2: Strategic deviation has an impact on firm performance.

The following specification were used for the relationship between the strategic deviation and firm performance.

$$\mathrm{GPM} = \beta_{10} + \beta_{11}\mathrm{SD} + \beta_{12}aSIZE + \beta_{13}LEV + Year + Ind + \varepsilon_1 \quad (2\text{-}1)$$

$$\mathrm{ROA} = \beta_{20} + \beta_{21}\mathrm{SD} + \beta_{22}aSIZE + \beta_{23}LEV + Year + Ind + \varepsilon_2 \quad (2\text{-}2)$$

To test each of the hypotheses H2a-H2b, the above models (1)-(2) were used. In the above equation, GPM and ROA are the dependent variables. GPM represents the company's operating performance and ROA represents the company's financial performance. SD represents the degree of strategic deviation, Year and Ind represent the dummy variables for year and industry respectively, β_{10} to β_{23} were regression coefficients, ε represents a random disturbance term.

3.6.3 Model 3

H3: Supply chain concentration has an impact on a firm's trade credit financing.

The following specification were used for the relationship between the supply chain concentration and trade credit financing.

$$TC_S = \chi_{10} + \chi_{11}SC + \chi_{12}aSIZE + \chi_{13}LEV + Year + Ind + \varepsilon_1 \quad (3\text{-}1)$$

$$TC\mathrm{r} = \chi_{20} + \chi_{21}CC + \chi_{22}aSIZE + \chi_{23}LEV + Year + Ind + \varepsilon_2 \quad (3\text{-}2)$$

To test each the hypotheses H3a-H3b, the above models (1)-(2) were used. In the above equation, TCS and TCr represents the dependent variable, The trade credit financing in supplier transactions and in customer transactions, CC represents the degree of customer concentration, SC represents the degree of supplier concentration, Year and Ind represent the dummy variables for year and industry respectively, χ_{10} to χ_{23} were regression coefficients, ε represents a random disturbance term.

3.6.4 Model 4

H4: Strategic deviation has an impact on a firm's trade credit financing.

The following specification were used for the relationship between the strategic deviation and trade credit financing.

$$TC_S = \delta_{10} + \delta_{11}\mathrm{SD} + \delta_{12}aSIZE + \delta_{13}LEV + Year + Ind + \varepsilon_1 \quad (4\text{-}1)$$

$$TC\mathrm{r} = \delta_{20} + \delta_{21}\mathrm{SD} + \delta_{22}aSIZE + \chi_{23}LEV + Year + Ind + \varepsilon_2 \quad (4\text{-}2)$$

To test each the hypotheses H4a-H4b, the above models (1)-(2) were used. In the above equation, TCS and TCr represents the dependent variable, The trade credit financing in supplier transactions and in customer transactions, SD represents the degree of strategic deviation, Year and Ind represent the dummy variables for year and industry

respectively, δ_{10} to δ_{23} were regression coefficients, ε represents a random disturbance term.

3.6.5 Model 5

H5: Trade credit financing has an impact on firm performance.

The following specification were used for the relationship between the trade credit financing and firm performance.

$$\mathrm{GPM} = \eta_{10} + \eta_{11} TC_S + \eta_{12} aSIZE + \eta_{13} LEV + Year + Ind + \varepsilon_1 \quad (5\text{-}1)$$

$$\mathrm{ROA} = \eta_{20} + \eta_{21} TC_s + \eta_{22} aSIZE + \eta_{23} LEV + Year + Ind + \varepsilon_2 \quad (5\text{-}2)$$

$$\mathrm{GPM} = \eta_{30} + \eta_{31} TC_r + \eta_{32} aSIZE + \eta_{33} LEV + Year + Ind + \varepsilon_3 \quad (5\text{-}3)$$

$$\mathrm{ROA} = \eta_{40} + \eta_{41} TC_r + \eta_{42} aSIZE + \eta_{43} LEV + Year + Ind + \varepsilon_4 \quad (5\text{-}4)$$

To test each of the four hypotheses H5a-H5d, the above models (5-1) to (5-4) were used. In the above equation, GPM and ROA represents the dependent variable. GPM represents the company's operating performance and ROA represents the company's financial performance. TCS and TCr represents the independent variable. The trade credit financing in supplier transactions and in customer transactions, Year and Ind represent the dummy variables for year and industry respectively, η_{10} to η_{43} were regression coefficients, ε represents a random disturbance term.

3.6.6 Model 6

H6: Firm trade credit financing plays a mediating role in the impact of supply chain concentration and strategic deviation on firm performance.

The following specification were used to test the mediating role of firm trade credit financing in the impact of supply chain concentration and strategic deviation on firm performance.

$$\mathrm{GPM} = \kappa_{10} + \kappa_{11} SC + \kappa_{12} TC_S + \kappa_{13} aSIZE + \kappa_{14} LEV + Year + Ind + \varepsilon_1 \quad (6\text{-}1)$$

$$\mathrm{ROA} = \kappa_{20} + \kappa_{21} SC + \kappa_{22} TC_S + \kappa_{23} aSIZE + \kappa_{24} LEV + Year + Ind + \varepsilon_2 \quad (6\text{-}2)$$

$$\mathrm{GPM} = \kappa_{30} + \kappa_{31} CC + \kappa_{32} TC_r + \kappa_{33} aSIZE + \kappa_{34} LEV + Year + Ind + \varepsilon_3 \quad (6\text{-}3)$$

$$\mathrm{ROA} = \kappa_{40} + \kappa_{41} CC + \kappa_{42} TC_r + \kappa_{43} aSIZE + \kappa_{44} LEV + Year + Ind + \varepsilon_4 \quad (6\text{-}4)$$

$$\mathrm{GPM} = \kappa_{50} + \kappa_{51} SD + \kappa_{52} TC_S + \kappa_{53} aSIZE + \kappa_{54} LEV + Year + Ind + \varepsilon_5 \quad (6\text{-}5)$$

$$\mathrm{ROA} = \kappa_{60} + \kappa_{61} SD + \kappa_{62} TC_S + \kappa_{63} aSIZE + \kappa_{64} LEV + Year + Ind + \varepsilon_6 \quad (6\text{-}6)$$

$$\mathrm{GPM} = \kappa_{70} + \kappa_{71} SD + \kappa_{72} TC_r + \kappa_{73} aSIZE + \kappa_{74} LEV + Year + Ind + \varepsilon_7 \quad (6\text{-}7)$$

$$\mathrm{ROA} = \kappa_{80} + \kappa_{81} SD + \kappa_{82} TC_r + \kappa_{83} aSIZE + \kappa_{84} LEV + Year + Ind + \varepsilon_8 \quad (6\text{-}8)$$

To test the eight hypotheses H6a-H6h, models (6-1) to (6-8) above were used. Following Baron & Kenny (1986), Wen et al. (2004), Hayes & Preacher (2010), Wen & Ye (2014) for the analysis of mediation effects, the stepwise testing method was used to validate the mediation effects.

As shown in Figure 3.2, the coefficient "c" in Equation (1) represents the total effect of the independent variable X on the dependent variable Y. The coefficient "a" in Equation (2) represents the effect of the independent variable X on the mediator variable M. The coefficient "b" in Equation (3) represents the effect of the mediator variable M on the dependent variable Y, controlling for the influence of the independent variable X. The coefficient "c'" represents the direct effect of the independent variable X on the dependent variable Y after controlling for the influence of the mediator variable M.

The mediation effect was examined using the step-by-step regression method proposed by Baron & Kenny (1986). First, the regression of X on Y was analyzed to test the significance of the regression coefficient "c". If the regression coefficient "c" is significantly different from zero, the analysis proceeds to the next step. Second, the regression of X on M was analyzed to test the significance of the regression coefficient "a." Thirdly, the regression of M on Y was analysed to test the significance of the regression coefficient "b". If both the regression coefficients "a" and "b" were significantly different from zero, the final step of testing was conducted. Finally, the regression of X on Y, with the inclusion of the mediator variable M, was analyzed to test the significance of the regression coefficients "b" and "c'" If both coefficients "b" and "c'" were significantly different from zero, the mediation effect was established. If "c'" was not significant, then there was evidence of a fully mediation effect.

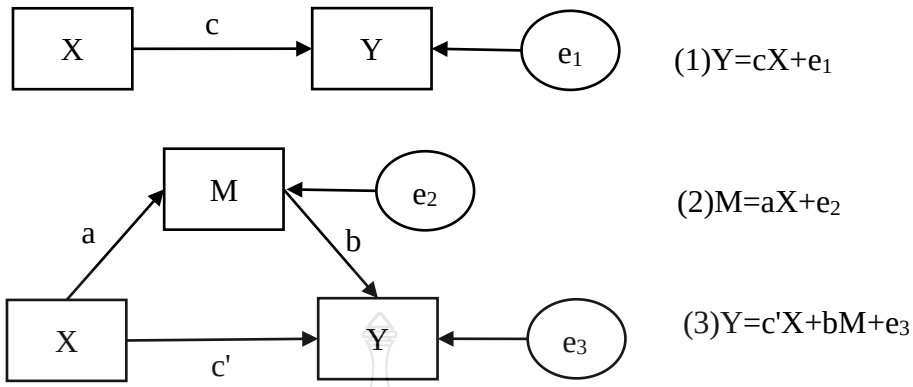

Figure 3.2 Regression mediation testing procedure

Based on the regression mediation effect test described above, the regression coefficients, α_{11} to α_{41}, β_{11} to β_{21}, χ_{11} to χ_{21}, δ_{11} to δ_{21} and η_{11} to η_{41} of models 1 to 5 were tested first and if they are significant, the test continues with model 6. Based on Baron & Kenny (1986), Wen & Ye (2014), if the regression coefficients α_{11} to α_{41} and β_{11} to β_{21} in models 1, 2 and the coefficient κ_{12} to κ_{82} in model 6 are significant, it means that the effect of supply chain concentration and strategic deviation on firm performance is mediated by the mediating variable trade credit financing. If the regression coefficient κ_{11} to κ_{81} in model 6 is not significant, it indicates a fully mediated process (Baron & Kenny, 1986). If it is significant, it indicates a partially mediated process, i.e. only part of the effect of supply chain concentration and strategic deviation on firm performance is realised through the mediating variable of firm trade credit financing.

3.6.7 Model 7

H7: Financing constraint plays a moderating role in the impact of supply chain concentration and strategic deviation on firms' trade credit financing.

The following specifications were used to test the moderating role of financing constraints in the relationship between supply chain concentration and strategic deviation on trade credit financing.

$$TC_S = \lambda_{10} + \lambda_{11}\mathrm{SC} + \lambda_{12}FC + \lambda_{13}SC * FC + \lambda_{14}aSIZE + \lambda_{15}LEV + Year + Ind + \varepsilon_1 \quad (7\text{-}1)$$

$$TC_r = \lambda_{20} + \lambda_{21}\mathrm{CC} + \lambda_{22}FC + \lambda_{23}CC * FC + \lambda_{24}aSIZE + \lambda_{25}LEV + Year + Ind + \varepsilon_2 \quad (7\text{-}2)$$

$$TC_S = \lambda_{30} + \lambda_{31}\mathrm{SD} + \lambda_{32}FC + \lambda_{33}SD * FC + \lambda_{34}aSIZE + \lambda_{35}LEV + Year + Ind + \varepsilon_3 \quad (7\text{-}3)$$

$$TC_r = \lambda_{40} + \lambda_{41}\mathrm{SD} + \lambda_{42}FC + \lambda_{43}SD * FC + \lambda_{44}aSIZE + \lambda_{45}LEV + Year + Ind + \varepsilon_4 \quad (7\text{-}4)$$

This study referenced the criteria for determining moderating effects from Korsgaard et al. (2002), Langfred (2004), and Muller et al. (2005). As shown in Figure 3.3, moderation effect examines whether the influence of X on Y was affected by the moderating variable W. Following the moderation effect testing procedure proposed by Muller et al. (2005), the first step involves centralizing both the independent and moderating variables. Then, equation (1) was established for hierarchical regression analysis. In the regression results, the significance of the regression coefficient of the interaction term X*W was observed. If it was significant, the moderation effect was confirmed. The conditional effect of X on Y can be expressed as a + cW. Therefore, when the coefficients c and a have the same sign, the moderation effect strengthens the impact of X on Y. Conversely, when c and a have opposite signs, the moderation effect weakens the influence of X on Y.

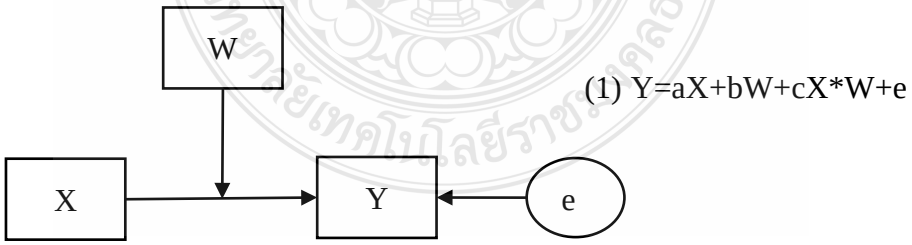

Figure 3.3 Model of moderating effects

The models (7-1) to (7-4) were used to test hypotheses H7a to H7d. In the above model, SC*FC, CC*FC, SD*FC represent the cross-multiplication terms of the independent variables and moderator variables respectively, and their regression coefficients will reflect the moderating effect of the independent variables on the dependent variables. The coefficients of the cross-multiplier terms are mainly observed in the regression results, and the existence of a moderating effect can be judged if they are significant (Muller et al., 2005).

3.6.8 Model 8

H8: Financing constraints significantly moderate the mediating role of trade credit financing.

The following specifications were used to examine the moderated mediation effect of financing constraints on the mediating variable trade credit financing.

$$\mathrm{GPM} = \mu_{10} + \mu_{11}SC + \mu_{12}\mathrm{FC} + \mu_{13}\mathrm{SC}*\mathrm{FC} + \mu_{14}\mathrm{TC_s} + \mu_{15}aSIZE + \mu_{16}LEV + Year + Ind + \varepsilon_1 \quad (8\text{-}1)$$

$$\mathrm{ROA} = \mu_{20} + \mu_{21}SC + \mu_{22}\mathrm{FC} + \mu_{23}\mathrm{SC}*\mathrm{FC} + \mu_{24}\mathrm{TC_s} + \mu_{25}aSIZE + \mu_{26}LEV + Year + Ind + \varepsilon_2 \quad (8\text{-}2)$$

$$\mathrm{GPM} = \mu_{30} + \mu_{31}CC + \mu_{32}\mathrm{FC} + \mu_{33}\mathrm{CC}*\mathrm{FC} + \mu_{34}\mathrm{TC}_r + \mu_{35}aSIZE + \mu_{36}LEV + Year + Ind + \varepsilon_3 \quad (8\text{-}3)$$

$$\mathrm{ROA} = \mu_{40} + \mu_{41}CC + \mu_{42}\mathrm{FC} + \mu_{43}\mathrm{CC}*\mathrm{FC} + \mu_{44}\mathrm{TC}_r + \mu_{45}aSIZE + \mu_{46}LEV + Year + Ind + \varepsilon_4 \quad (8\text{-}4)$$

$$\mathrm{GPM} = \mu_{50} + \mu_{51}\mathrm{SD} + \mu_{52}\mathrm{FC} + \mu_{53}\mathrm{SD}*\mathrm{FC} + \mu_{54}\mathrm{TC_s} + \mu_{55}\mathrm{TC}_r + \mu_{56}aSIZE + \mu_{57}LEV + Year + Ind + \varepsilon_5 \quad (8\text{-}5)$$

$$\mathrm{ROA} = \mu_{60} + \mu_{61}\mathrm{SD} + \mu_{62}\mathrm{FC} + \mu_{63}\mathrm{SD}*\mathrm{FC} + \mu_{64}\mathrm{TC_s} + \mu_{65}\mathrm{TC}_r + \mu_{66}aSIZE + \mu_{67}LEV + Year + Ind + \varepsilon_6 \quad (8\text{-}6)$$

Drawing from the criteria for moderated mediation by Langfred (2004), Muller et al. (2005), and Hayes (2015), this study assesses whether the indirect effect of X on Y through M was moderated. As illustrated in Figure 3.4, after considering both the mediated and simple moderated effects, W and XW were introduced into equation (1) to

moderate the direct effect of X on Y (represented by the dashed line path in Figure 3.3). This approach gives rise to the first-stage direct effect moderation model described by Edwards & Lambert (2007).

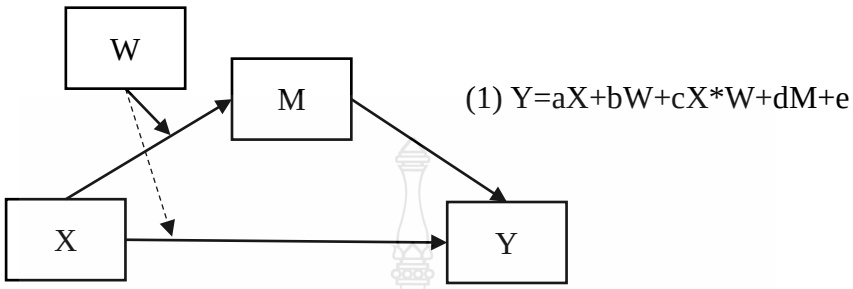

Figure 3.4 A moderated mediation model

The models (8-1) to (8-6) were used to test hypotheses H8a to H8f. In the models mentioned above, it is initially necessary to standardize the independent variable, mediator, and moderating variable. Building upon the established mediated effects in models 6, the determination of whether the moderated mediation effect exists was based on the regression results in model 8. When the regression coefficients of SC*FC, CC*FC, and SD*FC in models (8-1) to (8-6) were significant, and μ_{14} to μ_{65} were also significant, it can be concluded that the moderated mediation effect exists (Muller et al., 2005; Hayes, 2015).

3.7 Robustness Test

The purpose of robustness testing was to verify the reliability of the conclusions drawn from a model. This is achieved by altering certain parameters within the model, conducting repeated experiments to assess whether the model maintains a relatively consistent and stable interpretation of the evaluation outcomes. If changes in parameter settings result in alterations in signs and significance, it indicates that the results are not robust.

In this study, robustness testing involves adjusting model variables, changing the measurement methods of dependent variables, and applying lag processing to variables, among other methods, to examine whether the model's test results exhibit

relative stability. Specifically, by subtracting the industry median from the operating and financial performance of manufacturing enterprises to reduce industry effects, GPMa and ROAa are used to represent the adjusted operating and financial performance, respectively. Using the same method to adjust for trade credit financing, TCsa and TCra refer to trade credit financing to suppliers and trade credit financing to customers, respectively, after industry adjustment. Company performance is measured by return on equity (ROE), which is the ratio of a company's net income to its average net assets. The financing constraint (FC) is lagged by one period to obtain the financing constraint (L.FC) with a lag of one period.

3.8 Chapter Summary

This study adopted an empirical research method to test the hypotheses by proposing research hypotheses based on theoretical analysis and analyzing the data by constructing a statistical model. This study examined the effects of supply chain concentration and strategic deviation on trade credit financing and firm performance and the mediating and moderating effects in their relationships by constructing a multiple linear regression model and selecting explanatory variables, explanatory variables, and control variables by drawing on previous research literature, respectively, with Chinese A-share listed manufacturing companies as the research object. The following methods were used: descriptive statistics, correlation coefficient analysis, univariate analysis and multiple linear regression analysis.

CHAPTER 4
RESEARCH RESULTS

4.1 Introduction

This chapter presents the findings of the study, encompassing descriptive statistics, univariate analyses, correlation analyses, multiple regression analyses, and robustness tests. In Models (1) and (2), the effects of supply chain concentration and strategic deviation on firm performance were examined, respectively. Models (3) and (4) assessed the impacts of supply chain concentration and strategic deviation on trade credit financing. Model (5) investigated the effect of trade credit financing on firm performance. Subsequently, based on the aforementioned tests, Model (6) explored the potential mediating effect of trade credit financing. Finally, Model (7) examined the moderating role of financing constraints. Model (8) tested for moderated mediation effects.

4.2 Descriptive Statistical Analysis

As depicted in Table 4.1, the descriptive statistics reveal that the mean value of supplier concentration for Chinese manufacturing listed companies is approximately 32.64 percent, indicating a wide range of values. The minimum supplier concentration is observed to be 7.41 percent, while the maximum reaches as high as 86.9 percent, with a standard deviation of 16.59 percent. Similarly, for customer concentration, the mean value is approximately 32.45 percent, showing a wide dispersion from a minimum of 5.22 percent to a maximum of 90.22 percent, and a standard deviation of 18.96 percent. Regarding strategic deviation, the mean is approximately 0.47, and the values span from a minimum of 0.12 to a maximum of 1.85, with a standard deviation of 0.24. This indicates that strategic deviation is a prevailing phenomenon among listed companies in the manufacturing sector.

For trade credit financing, net trade credit financing from suppliers, the mean is 0.22 and the median is 0.2, which is greater than 0, indicating that firms have access to more trade credit financing from suppliers for their transactions and that a buyer's market still dominates the market, and the range is not large, with a minimum value of -0.13 and a maximum value of 0.99.

In transactions with customers, the mean and median net trade credit financing in customer transactions are -0.26 and -0.23, respectively, both negative, indicating that Chinese manufacturing enterprises mainly focus on providing trade credit financing in customer transactions and obtain very little trade credit financing, reflecting the characteristics of the buyer's market for enterprises, and enterprises are generally in a weaker position when negotiating with customers.

Profitability: The mean gross profit margins (GPM) for listed manufacturing companies is 0.29, indicating a wide variation, with the minimum value being 0.01 and the maximum value reaching 0.85. This signifies significant diversity in the operating performance of listed manufacturing companies in China. Regarding financial performance (ROA), the mean value is 0.05, with the minimum being -0.22 and the maximum being 0.23, highlighting the high variability in firm performance.

Furthermore, the mean value of the financing constraint index (FC) for listed manufacturing firms is 0.68, with a range from -5.22 to 4.79, suggesting that financing constraints are pervasive among listed manufacturing firms. The mean of the main control variable, firm size (SIZE), is 8493847091.15 Yuan, and the difference between the maximum and minimum values is substantial, leading to non-normal distribution as indicated by skewness and kurtosis, necessitating data transformation. Moreover, the mean financial leverage (LEV) of listed manufacturing companies is 0.39, but with significant differences observed between the minimum and maximum values of 0.06 and 0.87, respectively.

Table 4.1 Descriptive statistics

Variable	N	Min	Max	Mean	SD	Skewness		Kurtosis	
						Statistic	Std. error	Statistic	Std. error
SC	7488	7.41	86.90	32.64	16.59	0.90	0.028	0.252	0.057
CC	7488	5.22	90.22	32.45	18.96	0.83	0.028	-0.045	0.057
SD	7488	0.12	1.85	0.47	0.24	1.74	0.028	4.39	0.057
GPM	7488	0.01	0.85	0.29	0.16	1.10	0.028	1.191	0.057
ROA	7488	-0.22	0.23	0.05	0.05	-0.36	0.028	3.022	0.057
TCs	7488	-0.13	0.99	0.22	0.16	1.04	0.028	2.096	0.057
TCr	7488	-1.10	0.18	-0.26	0.20	-1.05	0.028	1.399	0.057
FC	7488	-5.22	4.79	0.68	1.80	-0.65	0.028	0.256	0.057
LEV	7488	0.06	0.87	0.39	0.18	0.22	0.028	-0.713	0.057
SIZE(bn)	7488	0.0046	42.42	0.8494	2.1608	4.28	0.028	22.724	0.057

Note: *SC* = supplier concentration, *CC* = customer concentration, *SD* = strategic deviation, *TCs* = trade credit financing in supplier transactions, *TCr* = trade credit financing in customer transactions, *GPM* = Gross profit margin, *ROA* = Financial performance, *FC* = Financing constraints, *SIZE* = firm size, *LEV* = leverage.

Following Benoit (2011), we applied a logarithmic transformation to the total assets to mitigate the impact of significant differences in firm size in our analysis. The transformed firm size is denoted as aSIZE. The descriptive analysis of aSIZE is presented in Table 4.2. The mean value of aSIZE is 22.08, which results in a smaller range between the maximum and minimum values.

Table 4.2 Descriptive statistics (LogSIZE)

Variable	N	Min	Max	Mean	Sd	Skewness		Kurtosis	
						Statistic	Std. error	Statistic	Std. error
SC	7488	7.41	86.90	32.64	16.59	0.90	0.028	0.252	0.057
CC	7488	5.22	90.22	32.45	18.96	0.83	0.028	-0.045	0.057
SD	7488	0.12	1.85	0.47	0.24	1.74	0.028	4.39	0.057
GPM	7488	0.01	0.85	0.29	0.16	1.10	0.028	1.191	0.057
ROA	7488	-0.22	0.23	0.05	0.05	-0.36	0.028	3.022	0.057
TCs	7488	-0.13	0.99	0.22	0.16	1.04	0.028	2.096	0.057
TCr	7488	-1.10	0.18	-0.26	0.20	-1.05	0.028	1.399	0.057
FC	7488	-5.22	4.79	0.68	1.80	-0.65	0.028	0.256	0.057
LEV	7488	0.06	0.87	0.39	0.18	0.22	0.028	-0.713	0.057
aSIZE	7488	20.01	25.62	22.08	1.08	0.68	0.028	0.172	0.057

Note: SC = supplier concentration, CC = customer concentration, SD = strategic deviation, TCs = trade credit financing in supplier transactions, TCr = trade credit financing in customer transactions, GPM = Gross profit margin, ROA = Financial performance, FC = Financing constraints, aSIZE = the logarithm of the firm's total assets, LEV = leverage.

4.3 Univariate Analysis

This study also conducted a univariate analysis of firm performance and trade credit financing. Group comparisons of supplier concentration, customer concentration and strategic bias were made on the basis of median values. The results of the subgroup comparisons, the subgroup t-means test and the subgroup Wilcoxon rank sum test are reported and the results are presented in Table 4.3.

In terms of gross profit margin, the mean and median values of GPM for the group after the median supplier concentration are 0.278 and 0.24, respectively, and the mean and median values of GPM for the group before the median supplier concentration are 0.297 and 0.274, respectively. T-test and Wilcoxon test were passed. This provisionally supports hypothesis H1a. In terms of firm performance, the mean and median values of ROA for the group after the median supplier concentration are 0.045 and 0.041 respectively. the mean and median values of ROA for the group before the median supplier concentration are 0.046 and 0.041 respectively. The results indicate that only the t-test passes.

In the group with customer concentration above the median, the mean and median GPM are 0.266 and 0.243, respectively, while in the group below the median customer concentration, the mean and median GPM are 0.309 and 0.274, respectively. Therefore, hypothesis H1c is preliminarily supported. Similarly, in the group with customer concentration above the median, the mean and median ROA are 0.044 and 0.040, respectively, and in the group below the median, the mean and median ROA are 0.047 and 0.043, respectively. This also provisionally supports hypothesis H1d.

Regarding strategic deviation, in the group with strategic deviation above the median, the mean and median GPM are 0.264 and 0.24, respectively, while in the group below the median strategic deviation, the mean and median GPM are 0.311 and 0.268, respectively. The test results indicate that the mean and median of the group with small strategic deviation are significantly higher than those of the group with large strategic deviation. This provides preliminary support for hypothesis H2a.

In the group with strategic deviation above the median, the mean and median ROA are 0.042 and 0.037, respectively, while in the group below the median, the mean and median ROA are 0.048 and 0.045, respectively. This also provisionally supports

hypothesis H2b. The results suggest that the mean and median of the group with low strategic deviation are significantly higher than those of the group with high strategic deviation. This provides preliminary support for hypothesis H2b.

In the analysis of trade credit financing (TCs) in supplier transactions, the mean and median of trade credit financing are 0.189 and 0.157 respectively when supplier concentration is high, and 0.252 and 0.235 respectively when supplier concentration is low. When comparing the groups by the size of the strategic deviation, the mean and median trade credit financing from suppliers are 0.225 and 0.208 respectively when the strategic deviation is large, and 0.216 and 0.196 respectively when the strategic deviation is small. The amount of trade credit financing is more when the strategic deviation is large, and both the t-test and the rank-sum test are significant.

In the analysis of trade credit financing (TCr) in transactions with customers, it is observed that when the concentration of customers is higher, the mean and median of trade credit financing are -0.29 and -0.254, respectively. On the other hand, when the concentration of customers is lower, the mean and median of trade credit financing are -0.231 and -0.191, respectively. These results suggest that larger customer concentration is associated with lower trade credit financing by the firm. The T-test and rank sum test show that these differences are statistically significant.

In the analysis comparing the groups based on the size of the strategic deviation, it was observed that when the strategic deviation is higher, the mean and median of supplier trade credit financing are -0.262 and -0.226, respectively. Conversely, when the strategic deviation is lower, the mean and median of trade credit financing are -0.259 and -0.228, respectively. These preliminary findings suggest that a larger strategic deviation is associated with slightly lower trade credit financing. However, it is important to note that the t-test and rank sum test did not yield statistically significant results for these findings. Therefore, further testing and analysis are required to validate and confirm the significance of these results.

In summary, a higher supplier concentration leads to lower trade credit financing, partially confirming hypothesis H3a. This suggests that when supplier concentration is higher, the firm’s dependence on suppliers is greater, weakening its bargaining power and resulting in reduced trade credit financing. Similarly, greater

customer concentration is associated with reduced trade credit financing, partially supporting hypothesis H3b. This implies that higher customer concentration makes firms more reliant on their customers, reducing their bargaining power and trade credit financing.

Interestingly, as a company's strategic deviation increases, trade credit financing from suppliers also increases. In other words, with greater strategic deviation, suppliers are more inclined to provide incentives to the company. This finding initially contradicts hypothesis H4a. Finally, a higher firm's strategic deviation leads to lower trade credit financing from customers, partially supporting hypothesis H4b. This suggests that customers may be hesitant to offer more incentives to firms with greater strategic deviation due to increased risk considerations.

Table 4.3 Univariate group test results

Variable	**N**	**mean**	**min**	**max**	**median**	**sd**	**T-test**	**Wilcoxon test**
GPM								
After SC median	3742	0.278	0.040	0.780	0.240	0.168	-0.019*	-9.858*
Before SC median	3746	0.297	0.040	0.780	0.274	0.141		
After CC median	3745	0.266	0.040	0.780	0.243	0.136	-0.043*	-10.069*
Before CC median	3743	0.309	0.040	0.780	0.274	0.170		
After SD median	3744	0.264	0.040	0.780	0.240	0.144	-0.047*	-12.369*
Before SD median	3744	0.311	0.040	0.780	0.268	0.163		
ROA								
After SC median	3742	0.045	-0.127	0.183	0.041	0.050	0.0002*	-0.198
Before SC median	3746	0.046	-0.127	0.183	0.041	0.050		
After CC median	3745	0.044	-0.127	0.183	0.040	0.049	-0.003*	-2.305*
Before CC median	3743	0.047	-0.127	0.183	0.043	0.052		
After SD median	3744	0.042	-0.127	0.183	0.037	0.052	-0.006*	-6.278*
Before SD median	3744	0.048	-0.127	0.183	0.045	0.048		
TCs								
After SC median	3742	0.189	-0.070	0.739	0.157	0.165	-0.063*	-20.063*
Before SC median	3746	0.252	-0.070	0.739	0.235	0.150		
After SD median	3744	0.225	-0.070	0.739	0.208	0.161	0.010*	2.052*
Before SD median	3744	0.216	-0.070	0.739	0.196	0.147		

Table 4.3 Univariate group test results (Cont.)

Variable	N	mean	min	max	median	sd	T-test	Wilcoxon test
TCr								
After CC median	3745	-0.290	-0.917	0.074	-0.254	0.200	-0.058*	-14.677*
Before CC median	3743	-0.231	-0.917	0.074	-0.191	0.198		
After SD median	3744	-0.262	-0.917	0.074	-0.226	0.211	-0.003	0.821
Before SD median	3744	-0.259	-0.917	0.074	-0.228	0.191		

* Represents significant at 0.05.

Note: SC = Supplier concentration, CC = Customer concentration, SD = Strategic deviation, TCs = Trade credit financing in supplier transactions, TCr = Trade credit financing in customer transactions, GPM = Gross profit margin, ROA = Financial performance.

4.4 Correlation Analysis

Pearson's correlation coefficient is commonly used to assess the level of correlation between two variables. In this study, Table 4.4 presents Pearson's correlation coefficients to examine the relationships between the variables. It can be observed that all the correlation coefficients in the table are below 0.65, which is significantly lower than 0.75. This indicates that there is no severe issue of multicollinearity among the variables (Farrar & Glauber, 1967).

Table 4.4 Correlation analysis

	GPM	ROA	SC	CC	SD	TCs	TCr	FC	LEV	aSIZE
GPM	1									
ROA	0.434*	1								
SC	-0.096*	-0.009	1							
CC	-0.159*	-0.026*	0.182*	1						
SD	-0.116*	-0.119*	0.108*	0.097*	1					
TCs	0.108*	-0.119*	-0.265*	0.171*	0.049*	1				
TCr	-0.137*	0.167*	0.073*	-0.155*	-0.027*	-0.431*	1			
FC	-0.382*	-0.565*	-0.026*	0.01	0.090*	0.127*	-0.182*	1		
LEV	-0.436*	-0.362*	-0.135*	-0.022*	0.130*	0.173*	0.053*	0.614*	1	
aSIZE	-0.230*	-0.050*	-0.225*	-0.156*	0.109*	0.004	0.212*	0.183*	0.535*	1

* Correlation is significant at 0.05.

Note: SC = supplier concentration, CC = customer concentration, SD = strategic deviation, TCs = trade credit financing in supplier transactions, TCr = trade credit financing in customer transactions, GPM = Gross profit margin, ROA = Financial performance, FC = Financing constraints, aSIZE = the logarithm of the firm's total assets, LEV = leverage.

4.5 Multicollinearity Test

Multicollinearity manifests itself as a correlation between explanatory variables, which can distort the model or make it difficult to estimate accurately. In this study, prior to the regression analysis, variance inflation factor (VIF) tests were conducted on Models 1 to Models 8. The test outcomes, as depicted in Tables 4.5 to 4.10, reveal that the VIF values are significantly below the limit of 10 (Hair et al., 1995). Therefore, it can be inferred that there is no substantial multicollinearity among the variables within each model.

Table 4.5 Multicollinearity statistics testing (Model 1 and model 2)

Variable	Model 1				Model 2	
	(H1a) - (H1b)		(H1c) - (H1d)		(H2a) - (H2b)	
	Tolerance	VIF	Tolerance	VIF	Tolerance	VIF
SC	0.908	1.10				
CC			0.905	1.11		
SD					0.903	1.11
LEV	0.678	1.47	0.677	1.48	0.677	1.48
aSIZE	0.664	1.51	0.674	1.48	0.688	1.45
IND						
2	0.613	1.63	0.614	1.63	0.595	1.68
3	0.412	2.43	0.408	2.45	0.412	2.43
4	0.436	2.29	0.439	2.28	0.447	2.24
5	0.593	1.69	0.589	1.7	0.594	1.68
6	0.514	1.95	0.495	2.02	0.509	1.97
YEAR						
2	0.447	2.24	0.447	2.24	0.447	2.24
3	0.467	2.14	0.467	2.14	0.467	2.14
4	0.391	2.55	0.391	2.56	0.391	2.56
5	0.365	2.74	0.365	2.74	0.365	2.74
6	0.329	3.04	0.329	3.04	0.329	3.04
7	0.326	3.07	0.325	3.07	0.326	3.07
8	0.311	3.22	0.310	3.22	0.311	3.22

Dependent: Firm performance

Note: SC = supplier concentration, CC = customer concentration, SD = strategic deviation, aSIZE = the logarithm of the firm's total assets, LEV = leverage, IND = Industry dummy variables, YEAR = Year dummy variables.

Table 4.6 Multicollinearity statistics testing (Model 3 and model 4)

Variable	Model 3				Model 4	
	H3a		H3b		(H4a)-(H4b)	
	Tolerance	VIF	Tolerance	VIF	Tolerance	VIF
SC	0.908	1.10				
CC			0.905	1.11		
SD					0.903	1.11
LEV	0.678	1.47	0.677	1.48	0.677	1.48
aSIZE	0.664	1.51	0.674	1.48	0.688	1.45
IND						
2	0.613	1.63	0.614	1.63	0.595	1.68
3	0.412	2.43	0.408	2.45	0.412	2.43
4	0.436	2.29	0.439	2.28	0.447	2.24
5	0.593	1.69	0.589	1.7	0.594	1.68
6	0.514	1.95	0.495	2.02	0.509	1.97
YEAR						
2	0.447	2.24	0.447	2.24	0.447	2.24
3	0.467	2.14	0.467	2.14	0.467	2.14
4	0.391	2.55	0.391	2.56	0.391	2.56
5	0.365	2.74	0.365	2.74	0.365	2.74
6	0.329	3.04	0.329	3.04	0.329	3.04
7	0.326	3.07	0.325	3.07	0.326	3.07
8	0.311	3.22	0.310	3.22	0.311	3.22

Dependent: Trade credit financing

Note: SC = supplier concentration, CC = customer concentration, SD = strategic deviation, aSIZE = the logarithm of the firm's total assets, LEV = leverage, IND = Industry dummy variables, YEAR = Year dummy variables.

Table 4.7 Multicollinearity statistics testing (Model 5)

Variable	Model 5			
	(H5a)-(H5b)		(H5c)-(H5d)	
	Tolerance	VIF	Tolerance	VIF
TCs	0.865	1.16		
TCr			0.854	1.17
LEV	0.654	1.53	0.677	1.48
aSIZE	0.686	1.46	0.661	1.51
IND				
2	0.612	1.63	0.614	1.63
3	0.409	2.44	0.409	2.44
4	0.423	2.36	0.434	2.30
5	0.577	1.73	0.561	1.78
6	0.492	2.03	0.492	2.03
YEAR				
2	0.447	2.24	0.447	2.24
3	0.465	2.15	0.465	2.15

Table 4.7 Multicollinearity statistics testing (Model 5) (Cont.)

Variable	Model 5			
	(H5a)-(H5b)		(H5c)-(H5d)	
	Tolerance	VIF	Tolerance	VIF
4	0.390	2.56	0.390	2.56
5	0.363	2.75	0.364	2.75
6	0.328	3.05	0.329	3.04
7	0.324	3.08	0.325	3.07
8	0.308	3.24	0.309	3.23

Dependent: Firm performance

Note: TCs = trade credit financing in supplier transactions, TCr = trade credit financing in customer transactions, aSIZE = the logarithm of the firm's total assets, LEV = leverage, IND = Industry dummy variables, YEAR = Year dummy variables.

Table 4.8 Multicollinearity statistics testing (Model 6)

Variable	Model 6					
	(H6a) - (H6b)		(H6c) - (H6d)		(H6e) - (H6f)	
	Tolerance	VIF	Tolerance	VIF	Tolerance	VIF
SC	0.853	1.17				
CC			0.901	1.11		
SD					0.903	1.11
TCs	0.812	1.23			0.865	1.16
TCr			0.851	1.18		
LEV	0.653	1.53	0.675	1.48	0.653	1.53
aSIZE	0.650	1.54	0.647	1.54	0.682	1.47
IND						
2	0.611	1.64	0.613	1.63	0.593	1.69
3	0.409	2.44	0.406	2.46	0.409	2.44
4	0.418	2.39	0.428	2.34	0.423	2.36
5	0.577	1.73	0.557	1.80	0.576	1.74
6	0.492	2.03	0.477	2.10	0.487	2.05
YEAR						
2	0.447	2.24	0.447	2.24	0.447	2.24
3	0.465	2.15	0.465	2.15	0.465	2.15
4	0.390	2.56	0.390	2.56	0.390	2.56
5	0.363	2.75	0.364	2.75	0.363	2.75
6	0.328	3.05	0.328	3.04	0.328	3.05
7	0.324	3.08	0.325	3.08	0.324	3.08
8	0.308	3.24	0.309	3.24	0.308	3.24

Dependent: Firm performance

Note: SC = supplier concentration, CC = customer concentration, SD = strategic deviation, TCs = trade credit financing in supplier transactions, TCr = trade credit financing in customer transactions, aSIZE = the logarithm of the firm's total assets, LEV = leverage, IND = Industry dummy variables, YEAR = Year dummy variables.

Table 4.9 Multicollinearity statistics testing (Model 7)

Variable	Model 7					
	H7a		H7b		H7c-H7d	
	Tolerance	VIF	Tolerance	VIF	Tolerance	VIF
SC	0.907	1.10				
CC			0.904	1.11		
SD					0.890	1.12
FC	0.571	1.75	0.572	1.75	0.571	1.75
SC*FC	0.991	1.01				
CC*FC			0.989	1.01		
SD*FC					0.968	1.03
LEV	0.417	2.40	0.417	2.40	0.417	2.40
SIZE	0.633	1.58	0.640	1.56	0.653	1.53
IND						
2	0.612	1.63	0.613	1.63	0.589	1.70
3	0.411	2.44	0.407	2.46	0.411	2.43
4	0.435	2.30	0.439	2.28	0.447	2.24
5	0.592	1.69	0.589	1.7	0.594	1.68
6	0.513	1.95	0.495	2.02	0.508	1.97
YEAR						
2	0.447	2.24	0.447	2.24	0.447	2.24
3	0.462	2.16	0.462	2.16	0.463	2.16
4	0.390	2.56	0.390	2.56	0.390	2.56
5	0.364	2.75	0.364	2.75	0.364	2.75
6	0.329	3.04	0.329	3.04	0.329	3.04
7	0.326	3.07	0.325	3.08	0.326	3.07
8	0.311	3.22	0.310	3.22	0.311	3.22

Dependent: Trade credit financing

Note: SC = supplier concentration, CC = customer concentration, SD = strategic deviation, FC = Financing constraints, SC*FC = Cross-multiplier of supplier concentration and financing constraints, CC*FC = Cross-multiplier terms for customer concentration and financing constraints, SD*FC = Cross-multiplier terms for strategic deviation and financing constraints, aSIZE = the logarithm of the firm's total assets, LEV = leverage, IND = Industry dummy variables, YEAR = Year dummy variables.

Table 4.10 Multicollinearity statistics testing (Model 8)

Variable	Model 8					
	(H8a) - (H8b)		(H8c) - (H8d)		(H8e) - (H8f)	
	Tolerance	VIF	Tolerance	VIF	Tolerance	VIF
SC	0.851	1.17				
CC			0.900	1.11		
SD					0.890	1.12
FC	0.571	1.75	0.536	1.87	0.571	1.75
SC*FC	0.988	1.01				
CC*FC			0.988	1.01		

Table 4.10 Multicollinearity statistics testing (Model 8) (Cont.)

Variable	Model 8					
	(H8a) - (H8b)		(H8c) - (H8d)		(H8e) - (H8f)	
	Tolerance	VIF	Tolerance	VIF	Tolerance	VIF
SD*FC					0.967	1.03
TCs	0.810	1.23			0.865	1.16
TCr			0.796	1.26		
LEV	0.408	2.45	0.411	2.44	0.408	2.45
SIZE	0.621	1.61	0.627	1.60	0.648	1.54
IND						
2	0.610	1.64	0.612	1.63	0.586	1.71
3	0.408	2.45	0.405	2.47	0.408	2.45
4	0.418	2.39	0.427	2.34	0.423	2.37
5	0.575	1.74	0.555	1.80	0.576	1.74
6	0.491	2.04	0.477	2.10	0.486	2.06
YEAR						
2	0.446	2.24	0.447	2.24	0.446	2.24
3	0.461	2.17	0.462	2.16	0.461	2.17
4	0.389	2.57	0.389	2.57	0.389	2.57
5	0.362	2.76	0.363	2.75	0.363	2.76
6	0.328	3.05	0.328	3.05	0.328	3.05
7	0.324	3.08	0.325	3.08	0.324	3.09
8	0.308	3.24	0.309	3.24	0.308	3.24

Dependent: Firm performance

Note: SC = supplier concentration, CC = customer concentration, SD = strategic deviation, TCs = trade credit financing in supplier transactions, TCr = trade credit financing in customer transactions, FC = Financing constraints, SC*FC = Cross-multiplier of supplier concentration and financing constraints, CC*FC = Cross-multiplier terms for customer concentration and financing constraints, SD*FC = Cross-multiplier terms for strategic deviation and financing constraints, aSIZE = the logarithm of the firm's total assets, LEV = leverage, IND = Industry dummy variables, YEAR = Year dummy variables.

4.6 Hypothesis Testing

The Hausman test results for Models 1-8 indicate that all p-values were below 0.05, supporting the adoption of the fixed effects model for estimation. The fixed effects model assumes the existence of individual fixed effects and is more rigorous compared to the random effects model. Additionally, in the analysis, standard errors were adjusted for clustering at the firm level to account for the presence of correlation in the error terms, as it better reflects the true variability of the estimated coefficients (Petersen, 2008).

4.6.1 The Effect of Supply Chain Concentration on Firm Performance

To test hypotheses H1, this study conducted regressions on (1-1) to (1-4) in Model 1, and the results are presented in Table 4.11. Model 1 examines the effect of supplier concentration and customer concentration on firm performance, and the results are shown in (H1a) to (H1d).

In the results for (H1a), the independent variable supplier concentration (SC) shows a significantly negative effect on the dependent variable GPM at the 0.05 level of significance. Additionally, both firm size and leverage coefficients are significant at the 0.05 level of significance. Therefore, this study supports hypothesis H1a. For result (H1b), the independent variable supplier concentration (SC) has a significantly positive effect on the dependent variable ROA at the 0.05 level of significance. Likewise, the coefficients of firm size and leverage are significant at the 0.05 level of significance, supporting hypothesis H1b. These regression results reveal that higher supplier concentration negatively affects a firm's gross profit margin due to increased dependency on suppliers and reduced bargaining power. On the other hand, higher supplier concentration positively impacts firm performance as it provides cost advantages and fosters efficient cooperation between the firm and its suppliers.

In result (H1c), the independent variable customer concentration (CC) has a negative significant effect on the dependent variable GPM at 0.05 level of significance. And both firm size and leverage coefficients are significant at 0.05 level of significance. Therefore, this supports hypothesis H1c in this study. In result (H1d), the independent variable customer concentration (CC) has a positive significant effect on the dependent variable ROA at 0.05 level of significance. Meanwhile, the coefficients of firm size and leverage are significant at 0.05 level of significance. Therefore, hypothesis H1d is supported. The regression results suggest that in the gross profit margin, when customer concentration is high, firms are more dependent on their customers, which forces firms to agree to terms more favourable to large customers (Yli-Renko & Janakiraman, 2008), which negatively affects the growth rate of firms' operating income. In the long run, high customer concentration indicates that mutual trust and dependence between firms and large customers will gradually deepen and stabilise, and large customers will be more willing to further cooperate with firms, which can improve firms' operating efficiency (Irvine et al., 2016), positively affecting firms' performance.

Table 4.11 The effect of supply chain concentration on firm performance (fixed-effects model)

VARIABLES	Model 1															
	(H1a)				(H1b)				(H1c)				(H1d)			
	GPM				ROA				GPM				ROA			
	Expected direction	β	t-stat	p-value	Expected direction	β	t-stat	p-value	Expected direction	β	t-stat	p-value	Expected direction	β	t-stat	p-value
Constant		-0.096	-0.989	0.323		-0.207*	-3.885	0.000		0.112*	-2.122	0.034		-0.202*	-3.842	0.000
SC	-	-0.001*	-2.266	0.024	+	0.001*	2.907	0.004								
CC									-	-0.001*	-3.310	0.001	+	0.001*	4.301	0.000
LEV	-	-0.121*	-8.758	0.000	-	-0.112*	-11.835	0.000	-	-0.121*	-8.729	0.000	-	-0.112*	-11.881	0.000
aSIZE	+	0.019*	4.255	0.000	+	0.014*	5.672	0.000	+	0.020*	4.356	0.000	+	0.014*	5.565	0.000
IND		Yes				Yes				Yes				Yes		
YEAR		Yes				Yes				Yes				Yes		
N		7488				7488				7488				7488		
R-squared		0.221				0.141				0.191				0.139		
F-stat		13.572*				16.831*				13.576*				17.001*		
(F-stat sig)		0.000				0.000				0.000				0.000		
Durbin-Watson		1.958				2.019				1.919				2.017		

* Represents significant at 0.05.

Note: SC = supplier concentration, CC = customer concentration, GPM = Gross profit margin, ROA = Financial performance, aSIZE = the logarithm of the firm's total assets, LEV = leverage, IND = Industry dummy variables, YEAR = Year dummy variables.

4.6.2 The Effect of Strategic Deviation on Firm Performance

To test hypotheses H2, this study conducted regressions on (2-1) to (2-2) in Model 2, and the results are presented in Table 4.12. Model 2 investigates the effect of strategic deviation on firm performance, and the results are shown in (H2a) to (H2b).

Results (H2a) and (H2b) show the results of testing hypothesis 2 of this study. The effect of the independent variable strategic deviation (SD) on the dependent variable GPM is not significant and therefore hypothesis H2a is not supported. This result differs from previous studies(Simon,1997; Goll et al., 2006). Strategic deviation (SD) has a negative and significant effect on ROA, both at the 0.05 level of significance. The coefficients of firm size and leverage are both significant at the 0.05 level. Therefore, hypotheses H2b of this study are supported. The regression results suggest that higher strategic deviation leads to more information asymmetry in Chinese listed manufacturing firms, and the resulting risk leads to a negative impact on firm performance.

Due to the lack of significance in H2a, which indicated that the independent variable SD had no significant impact on the firm's operational performance (GPM), the hypothesis H2a was not supported. Following Baron & Kenny's (1986) method for testing mediating effects, this study halted the examination of the mediating effects of TCs and TCr in strategic deviation and operational performance.

Table 4.12 The effect of strategic deviation on firm performance (fixed-effects model)

VARIABLES	Model 2							
	(H2a)				(H2b)			
	GPM				ROA			
	Expected direction	β	t-stat	p-value	Expected direction	β	t-stat	p-value
Constant		-0.127	-1.302	0.193		-0.176*	-3.342	0.001
SD	-	-0.001	-0.156	0.876	-	-0.021*	-4.103	0.000
LEV	-	-0.121*	-8.685	0.000	-	-0.111*	-11.691	0.000
aSIZE	+	0.020*	4.437	0.000	+	0.013*	5.411	0.000
IND		Yes				Yes		
YEAR		Yes				Yes		
N		7488				7488		
R-squared		0.212				0.154		
F-stat		13.237*				17.575*		
(F-stat sig)		0.000				0.000		
Durbin-Watson		1.906				2.015		

* Represents significant at 0.05.

Note: SD = strategic deviation, GPM = Gross profit margin, ROA = Financial performance, aSIZE = the logarithm of the firm's total assets, LEV = leverage, IND = Industry dummy variables, YEAR = Year dummy variables.

4.6.3 The Effect of Supply Chain Concentration on Firm Trade Credit Financing

To test hypotheses 3, this study regresses equations (3-1) to (3-2) of model 3, and the results are shown in table 4.13. Model 3 tests the effect of supplier concentration and customer concentration on firms' trade credit financing, and the results are shown in (H3a) and (H3b).

In result (H3a), the independent variable supplier concentration (SC) has a negative and significant effect on the dependent variable supplier trade credit (TCs) at the 0.05 level. Both firm size and leverage coefficients are significant at 0.05 level of significance. This is consistent with the findings of Giannetti et al. (2011) and Hirofumi et al. (2013), this supports hypothesis H3a in this study.

In result (H3b), the independent variable customer concentration (CC) has a negative significant effect on the dependent variable trade credit financing from customers (TCr) at 0.01 level of significance. Meanwhile, the coefficients of firm size and leverage are significant at 0.05 level of significance. This is similar to the findings of Dass et al (2015) and Fabbri & Klapper (2016). Therefore, hypothesis H3b is supported.

The regression results indicate that when supplier concentration is high, firms are more dependent on suppliers, firms' bargaining power is relatively low, and firms obtain less trade credit financing in supplier transactions. Similarly, when customer concentration is high, firms are more dependent on their customers, firms are in a weaker bargaining position with their customers, and customers will demand more credit and longer payment terms from firms, resulting in less trade credit financing from customers.

Table 4.13 The effect of supply chain concentration on firm trade credit financing (fixed-effects model)

VARIABLES	Model 3							
	(H3a)				(H3b)			
	TCs				TCr			
	Expected direction	β	t-stat	p-value	Expected direction	β	t-stat	p-value
Constant		-0.296	-1.856	0.064		-1.021*	-10.046	0.000
SC	-	-0.001*	-2.331	0.020				
CC					-	-0.001*	-2.918	0.004
LEV	-	0.226*	11.092	0.000	-	-0.061*	-2.122	0.034
aSIZE	+	0.019*	2.523	0.012	+	0.042*	8.870	0.000
IND		Yes				Yes		
YEAR		Yes				Yes		
N		7488				7488		
R-squared		0.079				0.148		
F-stat		17.154*				27.652*		
(F-stat sig)		0.000				0.000		
Durbin-Watson		1.967				1.992		

* Represents significant at 0.05.

Note: SC = supplier concentration, CC = customer concentration, TCs = trade credit financing in supplier transactions, TCr = trade credit financing in customer transactions, aSIZE = the logarithm of the firm's total assets, LEV = leverage, IND = Industry dummy variables, YEAR = Year dummy variables.

4.6.4 The Effect of Strategic Deviation on Firm Trade Credit Financing

To test hypotheses 4, this study regresses equations (4-1) to (4-2) of model 4, and the results are shown in table 4.14. Model 4 tests the effect of strategic deviation on corporate trade credit financing and the results are shown in (H4a) to (H4b).

In result (H4a), the independent variable strategic deviation (SD) exhibits a positive and significant effect on trade credit financing from suppliers (TCs) at the 0.05 level of significance. Additionally, both firm size and leverage coefficients are significant at the 0.05 level of significance. Interestingly, this result contradicts the findings of Ye et

al. (2014) and Hou et al. (2020). The difference in findings may be attributed to the fact that suppliers of Chinese manufacturing firms possess a better understanding of the firms' strategic intentions. The regression results indicate that suppliers are more perceptive to firms' strategic deviation information (Zhu, 2018) and are thus more inclined to provide additional trade credit financing. On the other hand, when it comes to customers, a larger strategic deviation leads to a higher degree of information asymmetry (Carpenter, 2000), making it more challenging for customers to interpret the firms' information. Consequently, this significantly restricts the scale of trade credit financing for firms (Hou et al., 2020).

However, the independent variable SD in the result (H4b) fails the significance test for trade credit financing from customers (TCr). This means that hypothesis H4b is not supported. Therefore, this study stops the mediation benefit test of TCr in strategic deviation and firm performance.

Table 4.14 The effect of strategic deviation on firm trade credit financing (fixed-effects model)

VARIABLES	Model 4							
	(H4a)				(H4b)			
	TCs				TCr			
	Expected direction	β	t-stat	p-value	Expected direction	β	t-stat	p-value
Constant		-0.355*	-2.270	0.023		0.147	0.689	0.491
SD	+	0.026*	2.100	0.036	-	-0.016	-1.134	0.257
LEV	-	0.224*	10.961	0.000	-	-0.013	-0.496	0.620
aSIZE	+	0.020*	2.792	0.005	+	0.016	1.644	0.100
IND		Yes				Yes		
YEAR		Yes				Yes		
N		7488				7488		
R-squared		0.078				0.025		
F-stat		16.737*				9.016*		
(F-stat sig)		0.000				0.000		
Durbin-Watson		1.831				1.994		

* Represents significant at 0.05.

Note: SD = strategic deviation, TCs = trade credit financing in supplier transactions, TCr = trade credit financing in customer transactions, aSIZE = the logarithm of the firm's total assets, LEV = leverage, IND = Industry dummy variables, YEAR = Year dummy variables.

4.6.5 The Effect of Trade Credit Financing on Firm Performance

In order to test hypothesis H5, this study regressed equations (5-1) to (5-4) of Model 5 and the results are shown in Table 4.15. Model 5 examines the impact of supplier trade credit financing and customer trade credit financing on firm performance and the results are shown in (H5a) to (H5d).

In result (H5a), the independent variable supplier trade credit (TCs) has a positive and significant effect on the dependent variable GPM at 0.05 level of significance. And both firm size and leverage coefficients are significant at 0.05 level of significance. Therefore, this supports hypothesis H5a in this study. In result (H5b), the independent variable trade credit facilities from suppliers (TCs) has a negative significant effect on the dependent variable ROA at 0.05 level of significance. Meanwhile, the coefficients of firm size and leverage are significant at the 0.05 level of significance. Hence, the regression results are contradictory to hypothesis H5b. The regression results indicate that in the gross profit margin, when trade credit financing from suppliers is larger, it positively affects the firm's sales growth rate. The reason for the contradiction between the regression results and hypothesis H5b may be that, in terms of financial performance, supplier trade credit financing could potentially increase a company's monitoring and management costs (Wang & Mao, 2009), thereby having a negative impact on corporate performance.

In result (H5c), the independent variable trade credit financing from customers (TCr) has a negative significant effect on the dependent variable GPM at the 0.05 level. The research findings contradict hypothesis H5c of this study. In result (H5d), trade credit financing from customers (TCr) has a positive significant effect on the dependent variable ROA at the 0.05 level, this is consistent with the findings of Su (2012) and Yu (2013). Meanwhile, the coefficients of firm size and leverage are significant at the 0.05 level of significance. Therefore, hypothesis H5d is supported. The regression results suggest in the gross profit margin, when trade credit financing from customers is larger, firms may be in an advantageous position, and when firms have more bargaining power, firms will be less likely to make concessions to their customers, which will negatively affect the growth rate of firms' operating income. In the financial performance, greater trade credit financing from customers means that firms can raise more funds from large customers without compensation, and the more funds available to firms, the more firms can increase investment, which in turn improves their performance.

Table 4.15 The effect of trade credit financing on firm performance (fixed-effects model)

VARIABLES	Model 5															
	(H5a)				(H5b)				(H5c)				(H5d)			
	GPM				ROA				GPM				ROA			
	Expected direction	β	t-stat	p-value	Expected direction	β	t-stat	p-value	Expected direction	β	t-stat	p-value	Expected direction	β	t-stat	p-value
Constant		-0.103	-1.073	0.283		-0.196*	-3.715	0.000		-0.125*	-2.382	0.017		-0.193*	-3.864	0.000
TCs	+	0.069*	5.015	0.000	-	-0.033*	-4.356	0.000								
TCr									-	-0.015*	-2.181	0.029	+	0.059*	9.301	0.000
LEV	-	-0.136*	-9.688	0.000	-	-0.105*	-10.968	0.000	-	-0.121*	-13.740	0.000	-	-0.113*	-12.084	0.000
aSIZE	+	0.019*	4.181	0.000	+	0.014*	5.661	0.000	+	0.020*	8.284	0.000	+	0.014*	6.114	0.000
IND		Yes				Yes				Yes				Yes		
YEAR		Yes				Yes				Yes				Yes		
N		7488				7488				7488				7488		
R-squared		0.290				0.129				0.232				0.152		
F-stat		14.764*				17.272*				24.773*				22.831*		
(F-stat sig)		0.000				0.000				0.000				0.000		
Durbin-Watson		1.932				2.014				2.016				1.915		

* Represents significant at 0.05.

Note: TCs = trade credit financing in supplier transactions, TCr = trade credit financing in customer transactions, GPM = Gross profit margin, ROA = Financial performance, aSIZE = the logarithm of the firm's total assets, LEV = leverage, IND = Industry dummy variables, YEAR = Year dummy variables.

4.6.6 A Test of the Mediating Effect of Trade Credit Financing

Based on the verification of hypotheses H1-H5, this study tests equations (6-1) to (6-6) in Model 6 (The mediating effect of trade credit financing from customers in the impact of strategic deviation on performance will no longer be tested.). The test results are shown in Table 4.16. According to Baron & Kenny (1986) and Hayes & Preacher's (2010) stepwise testing method for mediation effect. It has already been shown that the regression coefficients of the independent variables in Models 1-5 are significant (The regression coefficient of strategic deviation on operating performance is not significant and the regression coefficients of SD on TCr is not significant). If the coefficient of trade credit financing in Model 6 is also significant, it can be judged that trade credit financing plays an mediating role. And then we go on to judge whether it is fully mediated or not. The regression coefficient κ_{11} to κ_{18} in model 6 is not significant, indicating a fully intermediated process (Judd and Kenny, 1981). If it is significant, it indicates a partial mediation process. Meanwhile, this study refers to Wen & Ye (2014) for another Sobel test of the mediation effect.

In column (H6a), the Gross Profit Margin (GPM) is regressed on the mediating variables of trade credit financing from suppliers (TCs) and supplier concentration (SC), both simultaneously added to the model. The results of the regression indicate that the coefficients of supplier trade credit financing and supplier concentration are both significant, suggesting that supplier trade credit financing partially mediates the relationship between supplier concentration and gross profit margin. Furthermore, the Sobel mediation effect test confirms the mediation effect, with the calculated mediation effect accounting for 29.7 percent of the total effect. These results provide evidence that supplier concentration influences operational performance, in part, through the mechanism of supplier trade credit financing. The presence of trade credit financing from suppliers acts as a mediating factor that partially explains the relationship between supplier concentration and operational performance.

In column (H6b), we conduct a regression of Return on Assets (ROA) on the mediating variables, which are trade credit financing from suppliers (TCs) and supplier concentration (SC), both simultaneously added to the model. The results of the regression show that the coefficient of trade credit financing from suppliers is significantly negative.

And from the results of hypothesis H1b, it can be seen that supplier concentration positively affects firms' financial performance, which is also confirmed by the positive regression coefficient of SC in hypothesis H6b. Therefore, it can be known that supplier trade credit financing weakens the positive effect of supplier concentration on firm financial performance. Although the Sobel mediation effect test confirms the existence of a mediation effect, supplier trade credit financing cannot be considered as a strict mediator here.

Column (H6c) regresses GPM on two mediating variables, customer trade credit financing (TCr) and customer concentration (CC), which are also included in the model. The regression results show that the coefficient on trade credit financing from customers is insignificant, indicating that it does not play a mediating role. Hypothesis H6c did not pass the test.

In column (H6d), the mediating variables of trade credit financing from customers (TCr) and customer concentration (CC) are regressed on firms performance (ROA) by adding them to the model at the same time. The regression results show that the coefficient of trade credit financing from customers is significantly positive, indicating that it plays a partial mediating role and that customer concentration affects firms' performance through trade credit financing. In another Sobel test, the Sobel mediation effect test was passed.

Similarly, in column (H6f), firm performance (ROA) is regressed on the mediating variables, trade credit financing from suppliers (TCs) and strategic deviation (SD), both simultaneously included in the model. The regression results demonstrate that the coefficient of trade credit financing from suppliers is significantly negative, signifying its partial mediating role. Strategic deviation partially influences firms' performance through the mechanism of trade credit financing.

Table 4.16 Mediation effect test (fixed-effects model)

VARIABLES	Model 6															
	(H6a)				(H6b)				(H6c)				(H6d)			
	GPM				ROA				GPM				ROA			
	Expected direction	β	t-stat	p-value	Expected direction	β	t-stat	p-value	Expected direction	β	t-stat	p-value	Expected direction	β	t-stat	p-value
Constant		-0.076	-0.790	0.429		-0.216*	-4.098	0.000		-0.110	-1.116	0.265		-0.210*	-4.225	0.000
SC	-	-0.001*	-2.069	0.039	+	0.001*	2.695	0.007								
CC									-	-0.001	-1.810	0.071	+	0.001*	4.249	0.000
TCs	+	0.068*	4.978	0.000	-	-0.032*	-4.204	0.000								
TCr									-	-0.015	-1.360	0.174	+	0.059*	9.294	0.000
LEV	-	-0.136*	-9.738	0.000	-	-0.105*	-10.996	0.000	-	-0.121*	-8.728	0.000	-	-0.113*	-12.138	0.000
aSIZE	+	0.018*	4.021	0.000	+	0.014*	5.942	0.000	+	0.020*	4.296	0.000	+	0.014*	6.300	0.000
IND		Yes				Yes				Yes				Yes		
YEAR		Yes				Yes				Yes				Yes		
N		7488				7488				7488				7488		
R-squared		0.294				0.121				0.236				0.151		
F-stat		14.023*				16.800*				23.938*				22.130*		
(F-stat sig)		0.000				0.000				0.000				0.000		
Sobel Test (Z value)		-14.220*				3.875*				4.724*				-4.691*		
Durbin-Watson		1.960				2.017				1.937				2.016		

* Represents significant at 0.05.

Note: SC = supplier concentration, CC = customer concentration, TCs = trade credit financing in supplier transactions, TCr = trade credit financing in customer transactions, GPM = Gross profit margin, ROA = Financial performance, aSIZE = the logarithm of the firm's total assets, LEV = leverage, IND = Industry dummy variables, YEAR = Year dummy variables.

Table 4.16 Mediation effect test (fixed-effects model) (Cont.)

VARIABLES	Model 6 (H6f) ROA			
	Expected direction	**β**	**t-stat**	**p-value**
Constant		-0.187*	-3.578	0.000
SD	-	-0.021*	-3.967	0.000
TCs	-	-0.031*	-4.190	0.000
LEV	-	-0.104*	-10.862	0.000
aSIZE	+	0.014*	5.694	0.000
IND		Yes		
YEAR		Yes		
N		7488		
R-squared		0.137		
F-stat		17.480*		
(F-stat sig)		0.000		
Sobel Test (Z value)		1.239		
Durbin-Watson		2.013		

* Represents significant at 0.05.

Note: SD = strategic deviation, TCs = trade credit financing in supplier transactions, ROA = Financial performance, aSIZE = the logarithm of the firm's total assets, LEV = leverage, IND = Industry dummy variables, YEAR = Year dummy variables.

4.6.7 A Test of the Moderating Effect of Financing Constraints

To examine the moderating role of financing constraints in the relationship between supply chain concentration, strategic deviation and trade credit financing, Model 7 is employed, drawing inspiration from the works of Korsgaard et al. (2002), Langfred (2004), and Muller et al. (2005) that test for moderated effects. The outcomes of the tests for the moderating effect of financing constraints are detailed in Table 4.17.

In result H7a, the cross-multiplier term (SC*FC) of financing constraint (FC) and supplier concentration (SC) is not significant. It can be concluded that financing constraints do not play a moderating role in the relationship between supplier concentration and trade credit financing.

In regression result H7b, the cross-multiplier term (CC*FC) of customer concentration (CC) and financing constraints (FC) shows a significant positive effect on trade credit financing from customers (TCr) at the 0.05 significance level. Moreover, the effect of CC on TCr has a significant negative impact at the 0.05 significance level.

Therefore, we can conclude that financing constraints positively moderate the negative effect of customer concentration on trade credit financing from customers, aligning with the findings of Wang et al. (2016), Kang (2016), and Zhou & Wang (2017). In other words, as the value of the moderating variable increases, the negative effect of customer concentration on trade credit financing from customers diminishes, and financing constraints weaken the negative impact of customer firm concentration on trade credit financing.

In the regression results of models H7c and H7d, the regression coefficient of the interaction term SD*FC did not yield significant results. Therefore, it can be inferred that financing constraints did not play a moderating role in the relationship between strategic deviation and trade credit financing from suppliers. Hypotheses H7c and H7d are not supported.

Table 4.17 Moderating effect test (fixed-effects model)

VARIABLES	Model 7															
	(H7a) TCs				(H7b) TCr				(H7c) TCs				(H7d) TCr			
	Expected direction	β	t-stat	p-value	Expected direction	β	t-stat	p-value	Expected direction	β	t-stat	p-value	Expected direction	β	t-stat	p-value
Constant		-0.298	-1.845	0.065		-0.895*	-9.304	0.000		-0.347*	-2.233	0.026		0.279	1.419	0.156
SC	-	-0.001*	-2.302	0.021												
CC					-	-0.001*	-3.054	0.002								
SD									+	0.026*	2.116	0.034	-	-0.017	-1.214	0.225
FC	+	0.001	0.227	0.820	-	-0.035*	-14.605	0.000	+	0.001	0.311	0.756	-	-0.014*	-8.682	0.000
SC*FC	+	-0.001	-0.833	0.405												
CC*FC					+	0.001*	2.486	0.013								
SD*FC									+	-0.001	-0.053	0.958	+	0.003	0.565	0.572
LEV	-	0.225*	10.079	0.000	-	0.193*	5.743	0.000	-	0.222*	9.868	0.000	-	0.101*	3.404	0.001
aSIZE	+	0.019*	2.556	0.011	+	0.031*	6.608	0.000	+	0.021*	2.846	0.004	+	-0.024*	-2.609	0.009
IND		Yes				Yes				Yes				Yes		
YEAR		Yes				Yes				Yes				Yes		
N		7488				7488				7488				7488		
R-squared		0.079				0.204				0.078				0.048		
F-stat		29.820*				37.252*				15.091*				11.783*		
(F-stat sig)		0.000				0.000				0.000				0.000		
Durbin-Watson		1.967				1.985				1.845				2.009		

* Represents significant at 0.05.

Note: *SC* = supplier concentration, *CC* = customer concentration, *SD* = strategic deviation, *TCs* = trade credit financing in supplier transactions, *TCr* = trade credit financing in customer transactions, *GPM* = Gross profit margin, *ROA* = Financial performance, *FC* = Financing constraints, SC*FC = Cross-multiplier of supplier concentration and financing constraints, CC*FC = Cross-multiplier terms for customer concentration and financing constraints, SD*FC = Cross-multiplier terms for strategic deviation and financing constraints, aSIZE = the logarithm of the firm's total assets, LEV = leverage, IND = Industry dummy variables, YEAR = Year dummy variables.

4.6.8 Moderated Mediation Test

To examine the moderating mediating role of financing constraints in the relationship between supply chain concentration, strategic deviation, trade credit financing, and firm performance, Model 8 is employed, drawing inspiration from the works of Korsgaard et al. (2002), Langfred (2004), Muller et al. (2005) and Hayes, (2015) that test for moderated mediation effects. The outcomes of the tests for the moderated mediating effect of financing constraints are detailed in Table 4.18.

In result H8a and H8b, the cross-multiplier term (SC*FC) of financing constraint (FC) and supplier concentration (SC) is not significant. It can be concluded that financing constraints do not play a moderating role in the relationship between supplier concentration and trade credit financing. Therefore, the moderated mediating effect may not be present in the chain of sub-relationships. Similarly, in regression results H8e, the cross-multiplier term (SD*FC) of financing constraints (FC) and strategic deviation (SD) fails the significance test. Therefore, financing constraints may not have moderated mediating effects in the relationship between strategic deviation, trade credit financing and operating performance.

In regression result H8c, regarding the test of moderated mediation effect, the results show that the mediating variables, trade credit financing from customers (TCr) and customer concentration (CC), are both significant at the 0.05 level. However, hypothesis H6c, which posits the mediation of TCr, does not hold, indicating that the presence of moderating variables establishes the mediation effect of TCr. Furthermore, the cross-multiplier term (CC*FC) of customer concentration (CC) and financing constraints (FC) is significant and positive at the 0.05 level, signifying the existence of a conditional indirect effect. In other words, the mediating effect varies at different levels of FC, thus establishing a moderated mediating effect.

The results of model H8d show that the mediating variables trade credit financing from customers (TCr) and customer concentration (CC) are both significant at the 0.05 level, confirming the mediating role of TCr. Additionally, the cross-multiplier term (CC*FC) of customer concentration (CC) and financing constraints (FC) is significantly positive at the 0.05 level. Comparing the regression results of hypothesis H6d, the regression coefficient of TCr is significantly smaller, indicating the presence of

a conditional indirect effect. In other words, the moderating variable FC exerts different effects on the mediator variable TCr at different levels, establishing the moderated mediation effect.

In the previous analysis of model H6f, it was found that the mediating effect in supplier trade credit financing holds. In the test of model H8f, the interaction term SD*FC involving strategic deviation (SD) and financing constraints (FC) is significant, and the regression coefficient for TCs is also significant. When comparing the regression results to hypothesis H6f, it is evident that the regression coefficient for TCs has changed significantly, indicating the presence of a conditional indirect effect. In other words, the moderating variable FC exerts varying effects on the mediating variable TCs at different levels, thereby establishing a significant moderated mediation effect.

Table 4.18 Moderated mediation model test (fixed-effects model)

VARIABLES	Model 8															
	(H8a)				(H8b)				(H8c)				(H8d)			
	GPM				ROA				GPM				ROA			
	Expected direction	β	t-stat	p-value	Expected direction	β	t-stat	p-value	Expected direction	β	t-stat	p-value	Expected direction	β	t-stat	p-value
Constant		0.008	0.081	0.936		-0.118*	-2.428	0.015		-0.021	-0.218	0.827		-0.115*	-2.459	0.014
SC	-	-0.001*	-2.500	0.013	+	0.001*	2.264	0.024								
CC									-	-0.001*	-2.253	0.024	+	0.001*	3.704	0.000
FC	-	-0.009*	-11.553	0.000	-	-0.009*	-16.175	0.000	-	-0.009*	-12.023	0.000	-	-0.008*	-15.117	0.000
SC*FC	+	0.001	0.139	0.890	+	-0.001	-0.630	0.528								
CC*FC									+	0.001*	2.167	0.030	+	0.001*	2.047	0.041
TCs	+	0.068*	5.075	0.000	-	-0.031*	-4.372	0.000								
TCr									-	-0.031*	-2.927	0.003	+	0.045*	7.495	0.000
LEV	-	-0.080*	-5.586	0.000	-	-0.049*	-5.350	0.000	-	-0.061*	-4.299	0.000	-	-0.060*	-6.732	0.000
aSIZE	+	0.013*	2.853	0.004	+	0.009*	4.009	0.000	+	0.014*	3.070	0.002	+	-0.009*	4.260	0.000
IND		Yes				Yes				Yes				Yes		
YEAR		Yes				Yes				Yes				Yes		
N		7488				7488				7488				7488		
R-squared		0.105				0.142				0.096				0.152		
F-stat		20.231*				27.037*				19.173*				29.214*		
(F-stat sig)		0.000				0.000				0.000				0.000		
Durbin-Watson		1.962				2.022				1.947				2.021		

Table 4.18 Moderated mediation model test (fixed-effects model) (Cont.)

VARIABLES	Model 8 (H8f) ROA			
	Expected direction	**β**	**t-stat**	**p-value**
Constant		-0.107*	-2.210	0.027
SD	-	-0.019*	-3.958	0.000
FC	-	-0.009*	-16.042	0.000
SD*FC	+	-0.005*	-2.595	0.010
TCs	-	-0.031*	-4.340	0.000
LEV	-	-0.048*	-5.199	0.000
aSIZE	+	0.008*	3.751	0.000
IND		Yes		
YEAR		Yes		
N		7488		
R-squared		0.148		
F-stat		28.061*		
(F-stat sig)		0.000		
Durbin-Watson		2.021		

* Represents significant at 0.05.

Note: SC = supplier concentration, CC = customer concentration, SD = strategic deviation, TCs = trade credit financing in supplier transactions, TCr = trade credit financing in customer transactions, GPM = Gross profit margin, ROA = Financial performance, FC = Financing constraints, SC*FC = Cross-multiplier of supplier concentration and financing constraints, CC*FC = Cross-multiplier terms for customer concentration and financing constraints, SD*FC = Cross-multiplier terms for strategic deviation and financing constraints, aSIZE = the logarithm of the firm's total assets, LEV = leverage, IND = Industry dummy variables, YEAR = Year dummy variables.

4.7 Robustness Testing

The following robustness testing methodology is used in this study.

Considering that some industries have higher gross profit margin and financial performance while others have lower, the operating and financial performance of manufacturing firms is subtracted from the industry median to reduce the industry effect, and GPMa and ROAa are the industry-adjusted operating and financial performance. The regression results were presented in columns (H1a) to (H1d) of Table 4.19 and columns (H2a) to (H2b) of Table 4.20. The conclusions remain unchanged.

Trade credit financing from suppliers and trade credit financing from customers vary widely across industries, which are adjusted in this study by subtracting the industry median, and then regression analyses are performed for robustness testing. TCsa and TCra are the industry-adjusted trade credit financing from suppliers and trade credit financing from customers, respectively. The regression results were presented in columns (H3a) to (H3b) of Table 4.21 and columns (H4a) to (H4b) of Table 4.22. The conclusions remain unchanged.

This study uses the gross profit margin of manufacturing firms minus the industry median for adjustment, followed by regression analysis for robustness testing. Firm performance is measured by return on equity (ROE), which is the ratio of firms' net income to average net worth. Hypothesis H5 is tested using the above two proxies. The regression results are shown in (H5a) to (H5d) of table 4.23 and the conclusions remain the same.

In this study, in the robustness test of the mediation effect, the gross profit margin of manufacturing firms is subtracted from the industry median to reduce the influence of the industry, and return on equity (ROE) is used to measure the firm performance. Hypothesis H6 is tested by including the above two variables in Model 6 for regression analysis. The results are shown in (H6a) to (H6f) of Table 4.24 and the conclusions remain largely unchanged.

In this study, in the robustness test of the relationship between financing constraints affecting supply chain concentration and strategic deviation in trade credit financing, financing constraints (FC) are treated one period lagged to obtain one period lagged financing constraints (L.FC). Finally, L.FC was tested by incorporating it into the regression model. The results are shown in Table 4.25 and Table 4.26. The conclusions remain essentially the same.

Table 4.19 Industry-adjusted firm performance robustness test (Effects of supply chain concentration on performance)

VARIABLES	Model 1															
	(H1a)				(H1b)				(H1c)				(H1d)			
	GPMa				ROAa				GPMa				ROAa			
	Expected direction	β	t-stat	p-value	Expected direction	β	t-stat	p-value	Expected direction	β	t-stat	p-value	Expected direction	β	t-stat	p-value
Constant		-0.295*	-3.05	0.002		-0.257*	-4.837	0.000		-0.314*	-5.954	0.034		-0.251*	-4.779	0.000
SC	-	-0.001*	-2.153	0.031	+	0.001*	2.971	0.003								
CC									-	-0.001*	-2.195	0.028	+	0.001*	4.081	0.000
LEV	-	-0.110*	-8.008	0.000	-	-0.106*	-11.169	0.000	-	-0.110*	-12.532	0.000	-	-0.106*	-11.212	0.000
aSIZE	+	0.018*	4.074	0.000	+	0.014*	5.665	0.000	+	0.019*	7.879	0.000	+	0.014*	5.546	0.000
IND		Yes				Yes				Yes				Yes		
YEAR		Yes				Yes				Yes				Yes		
N		7488				7488				7488				7488		
R-squared		0.113				0.094				0.112				0.095		
F-stat		16.476*				18.173*				16.311*				18.066*		
(F-stat sig)		0.000				0.000				0.000				0.000		

* Represents significant at 0.05.

Note: SC = supplier concentration, CC = customer concentration, GPMa = gross profit margin-medianGPM(IND), ROAa = firm performance-medianROA(IND), aSIZE = the logarithm of the firm's total assets, LEV = leverage, IND = Industry dummy variables, YEAR = Year dummy variables.

Table 4.20 Industry-adjusted firm performance robustness test (Effects of strategic deviation on performance)

VARIABLES	Model 2							
	(H2a)				(H2b)			
	GPMa				ROAa			
	Expected direction	β	t-stat	p-value	Expected direction	β	t-stat	p-value
Constant		-0.324*	-3.344	0.001		-0.226*	-4.299	0.001
SD	-	0.001	0.008	0.993	-	-0.021*	-3.949	0.000
LEV	-	-0.110*	-7.955	0.000	-	-0.105*	-11.045	0.000
aSIZE	+	0.019*	4.242	0.000	+	0.013*	5.394	0.000
IND		Yes				Yes		
YEAR		Yes				Yes		
N		7488				7488		
R-squared		0.111				0.107		
F-stat		16.130*				18.721*		
(F-stat sig)		0.000				0.000		

* Represents significant at 0.05.

Note: SD = strategic deviation, GPMa = gross profit margin-medianGPM(IND), ROAa = firm performance-medianROA(IND), aSIZE = the logarithm of the firm's total assets, LEV = leverage, IND = Industry dummy variables, YEAR = Year dummy variables.

Table 4.21 Results of industry-adjusted robustness tests for trade credit financing (Effects of supply chain concentration on trade credit financing)

VARIABLES	Model 3							
	(H3a)				(H3b)			
	TCsa				TCra			
	Expected direction	β	t-stat	p-value	Expected direction	β	t-stat	p-value
Constant		-0.367*	-2.266	0.024		-0.923*	-9.102	0.000
SC	-	-0.001*	-2.268	0.023				
CC					-	-0.001*	-2.916	0.004
LEV	-	0.221*	10.901	0.000	-	-0.062*	-2.134	0.033
aSIZE	+	0.018*	2.377	0.018	+	0.042*	8.904	0.000
IND		Yes				Yes		
YEAR		Yes				Yes		
N		7488				7488		
R-squared		0.065				0.056		
F-stat		13.633*				8.460*		
(F-stat sig)		0.000				0.000		

* Represents significant at 0.05.

Note: SC = supplier concentration, CC = customer concentration, TCsa = trade credit financing in supplier transactions-medianTCs(IND), TCra = trade credit financing in customer transactions-medianTCr(IND), aSIZE = the logarithm of the firm's total assets, LEV = leverage, IND = Industry dummy variables, YEAR = Year dummy variables.

Table 4.22 Results of industry-adjusted robustness tests for trade credit financing (Effects of strategic deviation on trade credit financing)

VARIABLES	Model 4							
	(H4a)				(H4b)			
	TCsa				TCra			
	Expected direction	β	t-stat	p-value	Expected direction	β	t-stat	p-value
Constant		-0.424*	-2.719	0.007		0.217	1.082	0.279
SD	+	0.025*	1.993	0.046	-	-0.014	-1.002	0.316
LEV	-	0.219*	10.779	0.000	-	0.010	0.374	0.708
aSIZE	+	0.019*	2.635	0.009	+	-0.014	-1.523	0.128
IND		Yes				Yes		
YEAR		Yes				Yes		
N		7488				7488		
R-squared		0.064				0.015		
F-stat		13.140*				2.630*		
(F-stat sig)		0.000				0.000		

* Represents significant at 0.05.

Note: SD = strategic deviation, TCsa = trade credit financing in supplier transactions-medianTCs(IND), TCra = trade credit financing in customer transactions-medianTCr(IND), aSIZE = the logarithm of the firm's total assets, LEV = leverage, IND = Industry dummy variables, YEAR = Year dummy variables.

Table 4.23 Results of robustness tests of trade credit financing on firm performance

VARIABLES	Model 5															
	(H5a)				(H5b)				(H5c)				(H5d)			
	GPMa				ROE				GPMa				ROE			
	Expected direction	β	t-stat	p-value	Expected direction	β	t-stat	p-value	Expected direction	β	t-stat	p-value	Expected direction	β	t-stat	p-value
Constant		-0.302*	-3.150	0.002		-0.513*	-4.838	0.000		-0.323*	-3.324	0.001		-0.507*	-5.036	0.000
TCs	+	0.066*	4.895	0.000	-	-0.057*	-4.036	0.000								
TCr									-	-0.011	-1.019	0.308	+	0.107*	8.110	0.000
LEV	-	-0.125*	-8.930	0.000	-	-0.135*	-6.955	0.000	-	-0.110*	-7.970	0.000	-	-0.149*	-7.840	0.000
aSIZE	+	0.018*	4.012	0.000	+	0.031*	6.356	0.000	+	0.019*	4.195	0.000	+	0.032*	6.789	0.000
IND		Yes				Yes				Yes				Yes		
YEAR		Yes				Yes				Yes				Yes		
N		7488				7488				7488				7488		
R-squared		0.122				0.046				0.112				0.062		
F-stat		17.970*				10.281*				16.170*				14.592*		
(F-stat sig)		0.000				0.000				0.000				0.000		

* Represents significant at 0.05.

Note: TCs = trade credit financing in supplier transactions, TCr = trade credit financing in customer transactions, GPM a = gross profit margin-medianGPM(IND), ROE = return on equity, aSIZE = the logarithm of the firm's total assets, LEV = leverage, IND = Industry dummy variables, YEAR = Year dummy variables.

Table 4.24 Robustness test results for the mediation effect of trade credit financing

VARIABLES	Model 6															
	(H6a)				(H6b)				(H6c)				(H6d)			
	GPMa				ROE				GPMa				ROE			
	Expected direction	β	t-stat	p-value	Expected direction	β	t-stat	p-value	Expected direction	β	t-stat	p-value	Expected direction	β	t-stat	p-value
Constant		-0.276*	-2.895	0.004		-0.545*	-5.114	0.000		-0.313*	-3.184	0.001		-0.535*	-5.322	0.000
SC	-	-0.001*	-1.961	0.050	+	0.001*	2.261	0.024								
CC									-	-0.001	-1.226	0.220	+	0.001*	3.604	0.000
TCs	+	0.064*	4.862	0.000	-	-0.055*	-3.920	0.000								
TCr									-	-0.011	-1.006	0.315	+	0.106*	8.086	0.000
LEV	-	-0.125*	-8.973	0.000	-	-0.136*	-6.984	0.000	-	-0.110*	-7.976	0.000	-	-0.149*	-7.851	0.000
aSIZE	+	0.017*	3.866	0.000	+	0.032*	6.551	0.000	+	0.019*	4.135	0.000	+	0.032*	6.938	0.000
IND		Yes				Yes				Yes				Yes		
YEAR		Yes				Yes				Yes				Yes		
N		7488				7488				7488				7488		
R-squared		0.123				0.048				0.112				0.065		
F-stat		17.150*				9.990*				15.411*				14.260*		
(F-stat sig)		0.000				0.000				0.000				0.000		
Sobel Test (Z value)		-14.332*				3.781*				4.737*				-4.638*		

Table 4.24 Robustness test for the mediation effect of trade credit financing (Cont.)

VARIABLES	Model 6 (H6f) ROA			
	Expected direction	**β**	**t-stat**	**p-value**
Constant		-0.493*	-4.712	0.000
SD	-	-0.042*	-4.436	0.000
TCs	-	-0.054*	-3.844	0.000
LEV	-	-0.134*	-6.871	0.000
aSIZE	+	0.031*	6.398	0.000
IND		Yes		
YEAR		Yes		
N		7488		
R-squared		0.053		
F-stat		10.690*		
(F-stat sig)		0.000		
Sobel Test (Z value)		1.266		

* Represents significant at 0.05.

Note: SC = supplier concentration, CC = customer concentration, SD = strategic deviation, GPMa = gross profit margin-medianGPM(IND), ROE = return on equity, TCs = trade credit financing in supplier transactions, TCr = trade credit financing in customer transactions, aSIZE = the logarithm of the firm's total assets, LEV = leverage, IND = Industry dummy variables, YEAR = Year dummy variables.

Table 4.25 Robustness tests of the moderating effect of financing constraints

VARIABLES	Model 7															
	(H7a)				(H7b)				(H7c)				(H7d)			
	TCs				TCr				TCs				TCr			
	Expected direction	β	t-stat	p-value	Expected direction	β	t-stat	p-value	Expected direction	β	t-stat	p-value	Expected direction	β	t-stat	p-value
Constant		-0.330*	-2.855	0.004		-0.974*	-9.262	0.000		-0.347	-1.618	0.106		-0.088	-0.300	0.764
SC	-	-0.001	-1.149	0.251												
CC					-	-0.001*	-3.137	0.002								
SD									+	0.024	1.678	0.094	-	-0.016	-0.945	0.345
L.FC	+	0.006*	2.905	0.004	-	-0.034*	-7.529	0.000	+	-0.001	-0.255	0.799	-	-0.005	-1.602	0.109
SC*L.FC	-	-0.001*	-3.035	0.002												
CC*L.FC					+	0.001*	1.893	0.059								
SD*L.FC									-	0.003	0.539	0.590	+	-0.004	-0.650	0.516
LEV	-	0.216*	11.618	0.000	-	0.129*	3.525	0.000	-	0.208*	7.481	0.000	-	0.019	0.614	0.539
aSIZE	+	0.020*	3.856	0.011	+	0.035*	7.019	0.000	+	0.021*	2.162	0.031	+	-0.008	-0.571	0.568
IND		Yes				Yes				Yes				Yes		
YEAR		Yes				Yes				Yes				Yes		
N		5,422				5,422				5,422				5,422		
R-squared		0.066				0.192				0.065				0.027		
F-stat		17.751*				6.460*				7.960*				6.360*		
(F-stat sig)		0.000				0.000				0.000				0.000		

* Represents significant at 0.05.

Note: SC = supplier concentration, CC = customer concentration, SD = strategic deviation, TCs = trade credit financing in supplier transactions, TCr = trade credit financing in customer transactions, L.FC = Financing constraints with one-year lag, SC*L.FC = Cross-multiplier of supplier concentration and L.FC, CC*FC = Cross-multiplier terms for customer concentration and L.FC, SD*FC = Cross-multiplier terms for strategic deviation and L.FC, aSIZE = the logarithm of the firm's total assets, LEV = leverage, IND = Industry dummy variables, YEAR = Year dummy variables.

Table 4.26 Results of robustness tests of moderated mediation

VARIABLES	Model 8															
	(H8a)				(H8b)				(H8c)				(H8d)			
	GPM				ROA				GPM				ROA			
	Expected direction	β	t-stat	p-value	Expected direction	β	t-stat	p-value	Expected direction	β	t-stat	p-value	Expected direction	β	t-stat	p-value
Constant		-0.072	-0.671	0.503		-0.260*	-3.649	0.000		-0.113	-1.044	0.297		-0.226*	-4.291	0.000
SC	-	-0.001*	-2.055	0.040	+	0.001*	2.759	0.006								
CC									-	-0.001	-1.852	0.064	+	0.001*	2.751	0.006
L.FC	-	-0.003	-1.850	0.064	-	-0.004*	-3.296	0.001	-	-0.005*	-3.149	0.002	-	-0.004*	-4.378	0.000
SC*L.FC	+	-0.001	-0.828	0.408	-	0.001	0.305	0.760								
CC*L.FC									+	0.001	0.548	0.584	+	0.001*	2.120	0.034
TCs	+	0.068*	3.794	0.000	-	-0.038*	-4.051	0.000								
TCr									-	-0.018	-1.484	0.138	+	0.061*	9.870	0.000
LEV	-	-0.103*	-6.245	0.000	-	-0.087*	-7.584	0.000	-	-0.089*	-5.382	0.000	-	-0.096*	-11.278	0.000
aSIZE	+	0.018*	3.723	0.000	+	0.016*	5.060	0.000	+	0.020*	3.978	0.000	+	0.016*	6.529	0.000
IND		Yes				Yes				Yes				Yes		
YEAR		Yes				Yes				Yes				Yes		
N		5,422				5,422				5,422				5,422		
R-squared		0.073				0.081				0.062				0.096		
F-stat		10.780*				12.510*				9.950*				25.341*		
(F-stat sig)		0.000				0.000				0.000				0.000		

Table 4.26 Results of robustness tests of moderated mediation (Cont.)

VARIABLES	Model 8 (H8f) ROA			
	Expected direction	**β**	**t-stat**	**p-value**
Constant		-0.240*	-3.403	0.001
SD	-	-0.018*	-2.407	0.016
L.FC	-	-0.002*	-2.062	0.039
SD*L.FC	-	-0.003*	-1.519	0.129
TCs	-	-0.037*	-4.014	0.000
LEV	-	-0.084*	-7.261	0.000
aSIZE	+	0.016*	4.867	0.000
IND		Yes		
YEAR		Yes		
N		5,422		
R-squared		0.084		
F-stat		13.470*		
(F-stat sig)		0.000		

* Represents significant at 0.05.

Note: SC = supplier concentration, CC = customer concentration, SD = strategic deviation, TCs = trade credit financing in supplier transactions, TCr = trade credit financing in customer transactions, L.FC = Financing constraints with one-year lag, GPM = Gross profit margin, ROA = Financial performance, SC*L.FC = Cross-multiplier of supplier concentration and L.FC, CC*FC = Cross-multiplier terms for customer concentration and L.FC, SD*FC = Cross-multiplier terms for strategic deviation and L.FC, aSIZE = the logarithm of the firm's total assets, LEV = leverage, IND = Industry dummy variables, YEAR = Year dummy variables.

4.8 Chapter Summary

This chapter examines the relationship between supply chain concentration, strategic deviation, trade credit financing, firm performance and financing constraints through hypothesis testing and answers the four questions of this study.In the results of the hypothesis testing, most of the hypotheses were supported and some others did not pass, which will be specifically discussed in the next section. The test results are shown in Table 4.27.

Table 4.27 Hypothesis testing table for research questions

Research Questions	Hypotheses	Results
1	H1a: Supplier concentration negatively affects operating performance.	Support
	H1b: Supplier concentration positively affects financial performance.	Support
	H1c: Customer concentration negatively affects operating performance.	Support
	H1d: Customer concentration positively affects financial performance.	Support
	H2a: Strategic deviation negatively affects operating performance.	Not Support
	H2b: Strategic deviation negatively affects financial performance.	Support
2	H3a: Supplier concentration negatively affects trade credit financing from suppliers.	Support
	H3b: Customer concentration negatively affects trade credit financing from customers.	Support
	H4a: Strategic deviation positively affects trade credit financing from suppliers.	Support
	H4b: Strategic deviation negatively affects trade credit financing from customers.	Not Support
3	H5a: Trade credit financing from suppliers positively affects operating performance.	Support
	H5b: Trade credit financing from suppliers negatively affects financial performance.	Support
	H5c: Trade credit financing from customers negatively affects operating performance.	Support
	H5d: Trade credit financing from customers positively affects financial performance.	Support
4	H6a: Supplier concentration affects firms operating performance through trade credit financing from suppliers.	Support
	H6b: Supplier concentration affects firms financial performance through trade credit financing from suppliers.	Not Support
	H6c: Customer concentration affects firms operating performance through trade credit financing from customers.	Not Support
	H6d: Customer concentration affects firms financial performance through trade credit financing from customers.	Support
	H6e: Strategic deviation affects firms operating performance through trade credit financing from suppliers.	Not Support
	H6f: Strategic deviation affects firms financial performance through trade credit financing from suppliers.	Support

Table 4.27 Hypothesis testing table for research questions (Cont.)

Research Questions	Hypotheses	Results
5	H7a: Financing constraints moderate the relationship between supplier concentration and trade credit financing from suppliers.	Not Support
	H7b: Financing constraints moderate the relationship between customer concentration and trade credit financing from customers.	Support
	H7c: Financing constraints moderate the relationship between strategic deviation and trade credit financing from suppliers.	Not Support
	H7d: Financing constraints moderate the relationship between strategic deviation and trade credit financing from customers.	Not Support
	H8a: Financing constraints moderate the mediating effect of supplier trade credit financing on the relationship between supplier concentration and firm operational performance.	Not Support
	H8b: Financing constraints moderate the mediating effect of supplier trade credit financing on the relationship between supplier concentration and firm financial performance.	Not Support
	H8c: Financing constraints moderate the mediating effect of customer trade credit financing on the relationship between customer concentration and firm operational performance.	Support
	H8d: Financing constraints moderate the mediating effect of customer trade credit financing on the relationship between customer concentration and firm financial performance.	Support
	H8e: Financing constraints moderate the mediating effect of supplier trade credit financing on the relationship between strategic deviation and firm operational performance.	Not Support
	H8f: Financing constraints moderate the mediating effect of supplier trade credit financing on the relationship between strategic deviation and firm financial performance.	Support

CHAPTER 5
CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter is divided into five distinct sections. Section I encapsulates a summary of the empirical findings gleaned from this research. Section II offers a succinct summary of the research questions and the outcomes derived from the hypothesis testing. Section III provides an in-depth discourse on the research questions and the results of the hypothesis testing. Section IV elucidates the theoretical and pragmatic contributions that this study furnishes. Finally, Section V discusses the limitations inherent in this study and proposes potential directions for future research endeavors.

5.2 Conclusion

The primary objective of this study is to scrutinize the effects of supply chain concentration and strategic deviation on trade credit financing and firm performance. In addition, the study explores the moderating influence of financing constraints on the relationship between supply chain concentration, strategic deviation, and trade credit financing, along with the moderated mediation effects.

The research sample encompasses Chinese listed manufacturing companies operating in six sectors: petroleum and chemical products, pharmaceuticals, computer and telecommunications equipment, non-ferrous metal smelting and processing, machinery and equipment, and electrical machinery and equipment. Data were assembled from 2013 to 2020, culminating in a total of 7488 observations. Data indicators, including supply chain concentration and firm performance, were primarily sourced from the Chinese CSMAR database. Information pertinent to trade credit financing and capital for each company was manually compiled from the financial statements of the listed companies. The financing constraints indicator was obtained through regression analysis, following the research methodology proposed by Kaplan & Zingales (1997). Quantitative statistical methodologies were employed in this study, inclusive of descriptive statistical analysis, multiple linear regression, mediation analysis, and moderation effect analysis.

Additionally, robustness tests were executed to validate the research findings, and the results demonstrated consistency with the empirical discoveries.

There were five research questions:

Research question 1: How do supply chain concentration and strategic deviation affect the performance of Chinese listed manufacturing companies?

Research question 2: How do supply chain concentration and strategic deviation affect trade credit financing of Chinese listed manufacturing companies?

Research question 3: How does trade credit financing affect the performance of Chinese listed manufacturing companies?

Research question 4: How do supply chain concentration and strategic deviation affect firm performance through trade credit financing?

Research question 5: Do financing constraints play a moderating role in the relationship between supply chain concentration and strategic bias and trade credit financing? Moreover, do financing constraints significantly moderate the mediating effect of trade credit financing?

Based on the conceptual framework, this study has formulated eight hypotheses, as listed below:

Hypothesis 1: Supply chain concentration has an impact on firm performance.

Hypothesis 2: Strategic deviation has an impact on firm performance.

Hypothesis 3: Supply chain concentration has an impact on a firm's trade credit financing.

Hypothesis 4: Strategic deviation has an impact on a firm's trade credit financing.

Hypothesis 5: Trade credit financing has an impact on firm performance.

Hypothesis 6: Firm trade credit financing plays a mediating role in the impact of supply chain concentration and strategic deviation on firm performance.

Hypothesis 7: Financing constraint plays a moderating role in the impact of supply chain concentration and strategic deviation on firms' trade credit financing.

Hypothesis 8: Financing constraints significantly moderate the mediating role of trade credit financing.

The ensuing outcomes were derived from hypothesis testing. Distinct analyses were conducted to evaluate the ramifications of supplier concentration, customer concentration, and strategic deviation on firm performance and trade credit financing. The outcomes reveal that both supplier concentration and customer concentration impart a negative influence on firm operational performance, yet they positively influence financial performance. This discovery underscores the necessity of factoring in a firm's dependence on suppliers and customers, which aligns with the resource dependence theory and transaction cost theory in supply chain transactions. Additionally, it was discerned that strategic deviation exerts a significantly negative impact on a firm's financial performance but does not significantly impinge on its operational performance, suggesting an intensification in the information asymmetry between the firm and its stakeholders.

From the test outcomes of hypotheses 3 and 4, both supplier concentration and customer concentration were found to have significant and negative impacts on trade credit financing. However, differing impacts were observed for strategic deviation on trade credit financing. The outcomes signify that strategic deviation has a significantly positive impact on supplier trade credit financing, while its impact on customer trade credit financing is insignificant. These findings concur with the resource dependency theory and information asymmetry theory.

The outcomes of hypothesis 5 suggest that trade credit financing from suppliers has a significant positive impact on a firm's operational performance but a significant negative impact on its financial performance. In contrast, trade credit financing from customers significantly and negatively impacts a firm's operational performance but significantly and positively impacts its financial performance. Based on models 1 to 5, and in conjunction with the outcomes of model 6, it was determined that supplier concentration significantly influences firm performance through trade credit financing. Customer concentration significantly impacts a firm's financial performance through trade credit financing. Strategic deviation significantly influences a firm's financial performance through trade credit financing from suppliers.

The outcomes of hypothesis 7 culminate in the conclusion that financing constraints can only modulate the relationship between customer concentration and trade

credit financing from customers. The conclusions derived from Model 8 signify that financing constraints moderate the mediating effect of trade credit financing on the relationship between customer concentration and firm performance; these findings are consistent with the pecking order theory and resource dependency theory.

In conclusion, invaluable insights are provided into the intricate interplay of supply chain concentration, strategic deviation, trade credit financing, firm performance, and financing constraints in China's manufacturing industry. These outcomes illuminate the significance of considering a variety of factors when analyzing the financial dynamics and performance of Chinese manufacturers.

5.3 Discussion of Research Findings

This section provides a discussion of the research questions and the results of the research hypotheses. It is worth noting that the regression coefficients of the independent variables in the present investigation are generally relatively diminutive when they are significant. As postulated by Barry et al. (2006), even with relatively small coefficients, theoretical significance can still be substantial given a sufficient sample size. In this case, a total of 7488 observations were made, which is a considerable quantity. Consequently, the relatively small coefficients of the dependent variables and interaction terms do not impede the endorsement of the conclusions drawn here.

5.3.1 Research Question 1: How do supply chain concentration and strategic deviation affect the performance of Chinese listed manufacturing companies?

The empirical examination of the relationship between supply chain concentration, strategic deviation, and firm performance was conducted. The findings reveal that supplier concentration (SC) and customer concentration (CC) exert a negative impact on the operating performance of firms. However, strategic deviation (SD) does not exert a significant effect on the operating performance of the firm. These results are in alignment with prior research conducted by Crook & Combs (2007), AK and Patatoukas (2015), Campello & Gao (2017), and Kwak & Kim (2019).

With respect to financial performance (ROA), it is found that both supplier concentration and customer concentration exert a significantly positive impact on firms' financial performance, corroborating the findings of previous studies by Patatoukas

(2012), Irvine et al. (2016), and Krolikowski & Yuan (2017). Conversely, strategic deviation exerts a significantly negative impact on financial performance, which is commensurate with the conclusions drawn by Lei & Wang (2016).

In totality, the outcomes of the present investigation enrich the existing corpus of knowledge and offer valuable insights into the effects of supply chain concentration, strategic deviation, and financial performance within the milieu of Chinese manufacturing firms. These findings hold relevance for practitioners and policymakers in formulating informed decisions and developing efficacious strategies in the manufacturing industry.

Within Chinese manufacturing firms, a high level of supplier concentration may necessitate companies to invest more in materials and related equipment to safeguard the interests of suppliers, which can negatively impinge on the company's operational performance (Wang, 2012). Hence, a high degree of supplier concentration exerts an adverse effect on a company's operational performance, corroborating the hypothesis in H1a, where the coefficient of SC is expected to be significantly negative.

Nevertheless, in the long run, a closer collaboration with suppliers tends to mitigate conflicts and enhance cooperation efficiency (Shi et al., 2012). A high degree of supplier concentration can culminate in long-term cost advantages, curtailing uncertainties and risks in transactions (Bozarth et al., 2009; Yan et al., 2020), thereby ameliorating financial performance. Therefore, supplier concentration exerts a positive influence on a company's financial performance, supporting the hypothesis in H1b, where the coefficient of SC is expected to be significantly positive.

In a similar vein, in cases of high customer concentration, manufacturing firms lose negotiation leverage, potentially compromising their business operations (Kwak & Kim, 2019), which negatively affects their operational performance. In essence, customer concentration imposes an adverse impact on a company's operational performance. Thus, it is hypothesized in H1c that the coefficient of CC is significantly negative.

On the contrary, in the long term, a high degree of customer concentration curtails uncertainty and transaction costs in sales (Panos, 2012). Collaboration with major customers becomes more robust, enhancing operational efficiency (Irvine et al., 2016), ultimately culminating in positive effects on a company's financial performance.

Customer concentration is anticipated to exert a positive influence on a company's financial performance, supporting the hypothesis in H1d, where the coefficient of CC is expected to be significantly positive.

Additionally, a majority of researchers contend that the implementation of a differentiation strategy necessitates considerable upfront investments by companies, and the unique features of products may not be perceived by stakeholders in the short term (Tang et al., 2011). This could be a reason why strategic deviation does not significantly impinge on a company's operational performance (as hypothesized in H2a, where the coefficient of SD is expected to be non-significant).

However, in the long term, a greater degree of strategic deviation leads to enhanced financial performance volatility and uncertainty (Li & Zeng, 2017), often culminating in adverse effects on a company's financial performance. This hypothesis is confirmed in the present investigation. It is hypothesized in H2b that the coefficient of SD is significantly negative, indicating that in Chinese publicly listed manufacturing companies, strategic deviation negatively impacts financial performance.

5.3.2 Research Question 2: How do supply chain concentration and strategic deviation affect trade credit financing of Chinese listed manufacturing companies?

The conclusion of this research delineates that both supplier concentration (SC) and customer concentration (CC) exert a markedly negative influence on supplier trade credit financing and customer trade credit financing in that order. This empirical outcome corroborates the inferences made by Li & Liu (2016), thereby demonstrating a continuity in the research conclusions. Notably, the influence of strategic deviation (SD) on trade credit financing, when sourced from different commercial partners, manifests an array of results. Strategic deviation (SD) exerts a beneficial influence on trade credit financing procured from suppliers, a notion buttressed by the scholarly works of Guo & Wu (2019) and Fang & Chu (2019). However, it fails to impart a significant effect on trade credit financing derived from customers. This dichotomy of results underscores the nuanced complexities inherent in the relationship between strategic deviation and trade credit financing when interacting with diverse entities.

In terms of transactions with suppliers, Chinese manufacturing entities tend to display a pronounced level of supplier concentration. As a result, these entities often

circumscribe their procurement of raw materials and other activities to a handful of suppliers, thereby intensifying their reliance on these suppliers. In accordance with the resource dependence theory, a firm's bargaining strength diminishes in direct proportion to the increase in its dependence on external resources (Molina & Lorenzo, 2012). Hence, during the course of negotiations with suppliers, firms are likely to have a relatively diminished bargaining strength. Suppliers might stipulate payments to be made on time or even in advance, leading to a reduction in accounts payable liability and an increase in prepayments for the firm, which together culminate in a decrease in trade credit financing from suppliers. In essence, supplier concentration exerts a detrimental impact on trade credit financing obtained from suppliers. The regression findings in hypothesis H3a, wherein the regression coefficient of SC is significantly negative, support this observation.

In customer transactions, it has been observed that Chinese manufacturing companies are progressively adopting customer-centric strategies and operations, leading to a steady increase in customer concentration. Characteristically, high customer concentration compels firms to concentrate their sales efforts on a select group of key clientele whose demand for the firm's products leads to the firm being significantly dependent on them. This dependence, in turn, diminishes the firm's bargaining strength in relation to its customers (Giannetti, 2011). Hence, during negotiations, firms might acquiesce to customer demands to preserve a harmonious relationship and circumvent the potential costs associated with attracting new customers. This often leads firms to extend more credit to customers, offer extended payment terms that increases accounts receivable debt, lower prepayments, and ultimately, trade credit financing from customers diminishes. Therefore, it may be stated that customer concentration exerts a negative impact on trade credit financing from customers. This deduction is supported by the regression outcomes in hypothesis H3b, with the significantly negative regression coefficient of CC.

With regard to strategic deviation, empirical evidence suggests that Chinese manufacturing companies exhibit varying degrees of deviation, generally trending upwards. When companies experience significant strategic deviation, it becomes challenging for stakeholders to assess the firm's operational status and performance based

on industry norms. This further aggravates information asymmetry between the company and its stakeholders (Ye et al., 2015). Subsequently, due to factors such as operational risk and information risk, companies may encounter difficulties in securing trade credit financing from customers. In the hypothesis test for H4b, the regression coefficient of SD is not significant. As such, no definitive conclusion can be made regarding the influence of strategic deviation on trade credit financing from customers in publicly listed Chinese manufacturing companies.

On the other hand, there is a positive correlation between strategic deviation and trade credit financing from suppliers. It could be argued that this is due to the prevalent practice amongst publicly listed Chinese manufacturing companies of limiting their procurement activities to a select group of suppliers. In situations where suppliers are highly concentrated, they are more likely to discern the information conveyed by the company's strategic differences (Zhu, 2018). Therefore, in the interest of long-term mutual benefits, suppliers are more apt to extend additional trade credit financing to these companies. In publicly listed Chinese manufacturing companies, it can be asserted that strategic deviation has a positive impact on trade credit financing from suppliers. The significant positive coefficient of SD in hypothesis H4a substantiates this assertion.

5.3.3 Research Questions 3: How does trade credit financing affect the performance of Chinese listed manufacturing companies?

The current investigation discloses that trade credit financing from suppliers exerts a beneficial influence on the operational performance, whilst inflicting a detrimental effect on the financial performance of Chinese listed manufacturing firms. Paradoxically, trade credit financing procured from customers imparts a negative influence on operational performance, yet contributes beneficially to financial performance.

Upon evaluation of hypothesis H5b, it was discerned that the regression coefficient of TCs is significantly negative, implying that trade credit financing from suppliers adversely affects a company's financial performance. This finding is in stark contrast with the hypothesis proposed. Trade credit financing extended by suppliers essentially functions as interest-free working capital for firms, thereby allowing them to divert more resources to sales-oriented activities, which could potentially augment their

market share in the short term. However, over an extended period, trade credit financing from suppliers incurs higher management costs, default usage costs, and a myriad of hidden costs (such as potential damage to cooperative relationships, reputation, and bank-enterprise relations) as well as explicit costs (for instance, penalty fees) (Petersen & Rajan, 1997; Zheng et al., 2013). At this juncture, the costs of utilizing trade credit financing supersede the benefits, resulting in a decline in a company's financial performance (Nez-Solano, 2013). Given that publicly listed Chinese manufacturing firms typically exhibit a high degree of supplier concentration, these negative effects may be more apparent. This could provide a plausible explanation for the contradiction between the hypothesis and the test results.

The regression outcomes for hypothesis H5c imply a negative impact of trade credit financing from customers on a company's operational performance, contrary to the posited hypothesis H5c. This incongruity might arise due to the operational context wherein a high degree of customer concentration necessitates companies to make further concessions to customers, potentially impacting sales growth and thereby negatively influencing operational performance. However, in the long run, trade credit financing from customers augments a company's available resources, facilitating improved capital utilization, and ultimately amplifying investment levels and productivity (Guariglia & Mateut, 2006). This enhancement can contribute to superior financial performance. The test results for hypothesis H5d display a significantly positive regression coefficient of TCr, signifying a positive impact of trade credit financing from customers on a company's financial performance.

5.3.4 Research Question 4: How do supply chain concentration and strategic deviation affect firm performance through trade credit financing?

The mediating role of trade credit financing was examined in this study. While exploring the mediating impacts of trade credit financing on Chinese listed manufacturing companies, research methods espoused by Hayes & Preacher (2010) and Wen & Ye (2014) were employed. Hypotheses H1 and H3 were respectively subjected to testing to ascertain the significant effects of supplier concentration on firm performance and trade credit financing from suppliers. In the assessment of hypotheses H6a, the regression coefficient of TCs proved to be significant, thereby affirming that trade credit financing

mediates the impact of supplier concentration on firm operating performance. By amalgamating the results and discussions presented previously, it becomes apparent that alterations in supplier concentration influence the trade credit financing procured by a company, which subsequently impacts its performance.

In terms of customer concentration, the outcomes of hypothesis testing do not affirm the existence of a mediating effect of trade credit financing from customers on the relationship between customer concentration and operational performance; hypothesis H6c lacks validation. Given the multitude of factors influencing a company's operational performance, it is surmised that there could be other elements not incorporated in the model, which resulted in the non-validation of this mediating effect test. However, hypothesis H6d is substantiated, implying that customer concentration impacts a company's financial performance through trade credit financing. As previously alluded to, a company's customer concentration affects the quantum of trade credit financing procured from customers (Lee et al., 2018). The utilization of trade credit can curtail company costs and augment profits (Su, 2012; Yu, 2013). Therefore, changes in customer concentration influence the trade credit financing a company secures from customers, subsequently impacting its financial performance.

With regard to strategic deviation, the outcomes of the test for H6f suggest that trade credit financing from suppliers partially mediates the impact of strategic deviation on a company's financial performance. This is attributed to the tendency among Chinese manufacturing companies to strategically manage supply chain concentration and devise suitable strategies to influence trade credit financing, which ultimately impacts their financial performance.

5.3.5 Research Question 5: Do financing constraints play a moderating role in the relationship between supply chain concentration and strategic bias and trade credit financing? Moreover, do financing constraints significantly moderate the mediating effect of trade credit financing?

The current investigation elucidates that financing constraints only moderate the relationship between customer concentration and trade credit financing derived from customers. In circumstances of low financing constraints, a company's financing costs diminish, thereby facilitating the attainment of lower-cost and increased financial support.

Consequently, prominent customers often provide more favorable risk assessments of manufacturing companies. In such instances, financing constraints can mitigate the adverse influence of customer concentration on trade credit financing from customers. However, when a company's financing constraints escalate, both financing costs and difficulties experience a surge. At this juncture, customers can perceive the urgency of the company's repayment, and owing to risk considerations, they might curtail the provision of trade credit financing. Therefore, financing constraints amplify the detrimental effects of customer concentration on trade credit financing from customers.

In the test results for hypothesis H7a, the interaction term SC*FC is not significant, thereby precluding the conclusion that financing constraints moderate the relationship between supply chain concentration and trade credit financing from suppliers. This could be attributed to the fact that suppliers of Chinese manufacturing listed companies are generally stable and concentrated among a handful of suppliers. Suppliers may exhibit insensitivity to the financing constraints of the companies. Comparable situations also transpired in hypotheses H7c and H7d.

In the assessments of hypotheses H8c and H8d, the regression coefficients of the interaction term CC*FC between customer concentration and financing constraints are significant, and the regression coefficient of TCr is also significant. Consequently, it can be inferred that financing constraints moderate the mediating effect of trade credit financing on the relationship between customer concentration and firm performance. According to the criteria for determining moderated mediation effects outlined by Muller et al. (2005) and Hayes (2015), it is generally required that both the mediating effect and the moderating effect be established. However, in hypothesis H7, financing constraints do not significantly moderate the relationship between supply chain concentration and strategic deviation on trade credit financing. Therefore, hypotheses H8a, H8b, and H8f have not been substantiated by the tests.

5.4 Contribution of the Study

5.4.1 Theoretical Contribution

The intent of the present study is to bridge the discernable gap in the literature, by scrutinizing the impact of supply chain concentration on firm performance from the standpoint of supply chain transactions. In this capacity, it augments the theoretical corpus pertaining to factors influencing firm performance. Earlier investigations have predominantly concentrated on the repercussions from supplier concentration on firm performance, either from the supplier's viewpoint (Gu et al., 2017; Zhang et al., 2020) or from the perspective of customer concentration (Hui et al., 2018; Irvine et al., 2016). A limited number of these studies have amalgamated both facets within a singular framework to examine the collective effect of the characteristics of upstream and downstream supply chain transactions on firm performance.

Additionally, earlier scholarly pursuits have frequently depended on a single variable to denote firm performance, such as the return on assets (ROA) indicator (Uotila et al., 2009; Wu et al., 2012; Qi, 2021) or other metrics like return on equity (ROE) or enterprise value (Patatoukas, 2012; Masa'deh et al., 2015). However, both supply chain concentration and strategic deviation could potentially influence firm performance in operational as well as financial terms. Consequently, the current endeavor considers the impact of both supply chain concentration and strategic deviation on firms' operational and financial performance. This approach contributes to a more holistic understanding of the topic at hand and enriches the literature.

This study expands upon the study of the mechanism of the joint impact of supply chain concentration and strategic deviation on firm performance. It posits that supply chain concentration and strategic deviation will impact firms' trade credit financing, which will subsequently affect firm performance, with trade credit financing acting as a mediating factor. Earlier work has generally enhanced firm performance from the viewpoint that supply chain concentration aids in reducing transaction costs (Krolikowski & Yuan, 2017), diminishing the degree of information asymmetry (Irvine et al., 2016), and improving the production process and product technology (Casalin et al., 2017). However, taking trade credit financing as a pivotal link, research exploring the mechanism of the impact of supply chain transactions on firm performance from this

perspective is insufficient. The present investigation on the mechanism of the impact of trade credit financing on enterprise performance in supply chain concentration and strategic deviation can add to the related research in this area.

Moreover, this study introduces the variable of financing constraints and incorporates it into the model to probe the relationship between supply chain concentration, strategic deviation, and firms' trade credit financing, thereby investigating its moderating role. While some previous studies have delved into the link between supply chain concentration, strategic deviation, trade credit financing, and financing constraints (Xie et al., 2018; Sheng et al., 2018; Niskanen & Niskanen , 2006; Tang & Andrea, 2019), these research efforts often concentrate on identifying alternative sources of finance. The notion of financing constraints as a moderating variable in this context has rarely been contemplated. The insights gleaned from this study contribute to enriching the literature in this specific area of research.

5.4.2 Practical Contribution

Based on empirical examination and subsequent discussion of results, the present study can provide valuable insights for corporate management departments, executive leadership, shareholders, and investors.

Firstly, supply chain concentration has a significant bearing on a corporation's trade credit financing and performance. This research can guide corporate management departments in the rational adjustment of trade relationships by highlighting the importance of dynamic adaptation in cooperation with suppliers and customers. In scenarios of lower supplier concentration, management could strategically bolster cooperation with key suppliers, which would yield a positive impact on the company's financial performance. In customer transactions, vigilance should be exercised concerning the risks inherent to customer concentration, effectively leveraging customer trade credit financing to facilitate overall performance enhancement for the corporation. Investors may scrutinize fluctuations in a company's supply chain concentration with greater precision and refine their investment strategies accordingly. For instance, investors could, whilst accounting for risk factors, concentrate on the positive impact of amplified customer concentration on financial performance and make suitable adjustments to their investment strategies.

Secondly, strategic deviation exerts a negative influence on a firm's performance. The discussion of the study findings reveals that this negative impact primarily emanates from risks associated with information asymmetry. Consequently, this study advises management departments to emphasize communication with suppliers and customers during transactions, curtailing the adverse effects of strategic deviation. Simultaneously, when investors detect significant strategic deviations within a company, they should be cognizant of the potential negative ramifications and promptly review their investment strategies.

Thirdly, supply chain concentration and strategic deviation impact firm performance through trade credit financing. Executive leadership and shareholders can bolster firm performance by optimizing supply chain concentration and executing logical business strategies that enhance trade credit financing. This enables the effective allocation of funds towards other investments, such as business expansion and increasing investment in research and development. It is critical for managers and shareholders to actively advocate for open communication with suppliers to secure more trade credit financing, thereby amplifying the firm's financial performance.

Fourthly, financing constraints intensify the negative impact of customer concentration on trade credit financing from customers. This study counsels senior management in the development of suitable financial strategies, the expansion of financing channels, the reduction of financing restrictions, and the mitigation of the adverse effects of financing constraints. This opens up the possibility of obtaining more trade credit financing from customers and enhancing firm performance.

Finally, financing constraints moderate the mediating effect of trade credit financing. This study presents invaluable references for shareholders and executive leadership to formulate appropriate developmental strategies. Greater attention should be directed to the links between upstream and downstream supply chains when devising developmental strategies as competition amongst enterprises is gradually metamorphosing into competition amongst supply chains. This research underlines the significance of implementing close coordination and communication mechanisms with suppliers and customers in strategic planning. This timely communication not only

mitigates the negative impact of information asymmetry but also assists companies in securing more trade credit financing and improving its utilization.

5.5 Research Limitations and Future Research

5.5.1 Research Limitations

The limitations inherent in the present research are as follows:

1) The research is constrained by the limitations of data sources for supplier concentration and customer concentration. Due to the existing information disclosure policy pertaining to the financial statements of listed companies in China, supplier concentration is approximated by the proportion of the purchase amount from the company's top five suppliers relative to the total purchase amount. Similarly, customer concentration is gauged by the ratio of the sales amount of the company's top five customers to the company's total sales amount. However, it is unfeasible to obtain precise information on the specific suppliers and customers, the upstream and downstream enterprises, and the industry. Consequently, the analysis of suppliers and customers in this study is limited to the concentration index.

2) Strategic deviation is quantified by the methods proposed by Geletkanycz & Hambrick (1997), and Tang et al. (2011), who employ six indicators to compute the magnitude of corporate strategic deviation. As these six indicators do not encompass all facets of corporate strategy, the calculated strategic deviation does not fully and accurately reflect the strategic variances of the firm, thereby revealing some deficiencies in the measurement method.

3) The research model of this study predominantly draws upon previous research, selecting the size of the company and financial structure factors as control variables. Given the limitations of the data source, there may be some factors that have not been incorporated into the research model.

5.5.2 Future Research

The avenues for future scholarly endeavors informed by the current investigation can be outlined as follows:

1) Evolving beyond the examination of upstream and downstream supply chain transactions to encompass the scrutiny of multi-party networked transactions within the

supply chain. The present research is confined to the exploration of interactions between the upstream and downstream relationships of firms, synonymous with the transactions originating from suppliers, firms, and customers respectively. In practice, the relationships between enterprises are manifested as a network, with a more intricate influence relationship. Future research efforts should entertain the supply chain network as an entity in its entirety. The research should examine the selection of corporate financial policy within the structure of the supply chain network and its ensuing impact on financial performance.

2) Contemplating the introduction of additional stakeholder issues and examining the interaction amongst these. Beyond suppliers and customers, who constitute the two predominant external stakeholders, there are other stakeholders in the transaction, such as banks, investors, and professional managers. The competitive and cooperative dynamics between stakeholders can exert an interactive effect. Future research endeavors could incorporate a larger number of stakeholders within their framework, with the aim of investigating the financial policy decisions of companies under the influence of differing stakeholders' interactions.

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