Journal of Infrastructure, Policy and Development 2024, 8(2), 3178.
https://doi.org/10.24294/jipd.v8i2.3178

Article

Unveiling the connection among customer concentration, trade credit financing, and firm performance: A moderated mediation model

Meng Qiang, Kusuma Dampitakse, Nartraphee Tancho*

Faculty of Business Administration, Rajamangala University of Technology Thanyaburi, Pathum Thani 12110, Thailand
*** Corresponding author:** Nartraphee Tancho, nartraphee@rmutt.ac.th

CITATION

Qiang M, Dampitakse K, Tancho N. (2024). Unveiling the connection among customer concentration, trade credit financing, and firm performance: A moderated mediation model. Journal of Infrastructure, Policy and Development. 8(2): 3178. https://doi.org/10.24294/jipd.v8i2.3178

ARTICLE INFO

Received: 6 November 2023
Accepted: 1 December 2023
Available online: 27 December 2023

Abstract: The augmentation of firm performance via customer concentration is particularly indispensable for organizational evolution. Both trade credit financing and financing constraints play pivotal roles in the nexus between customer concentration and performance. This research constructs a moderated mediation model to rigorously investigate the impact of customer concentration on firm performance, positing trade credit financing as the mediating variable and financing constraints as the moderating variable. The relevant hypotheses are evaluated empirically using panel data compiled from listed manufacturing firms in China over the period 2013–2020, yielding 8 firm-year observations. The empirical outcomes denote that customer concentration exerts a positive influence on firm performance, albeit having a negative impact on trade credit financing. Trade credit financing serves as a partial mediator in the relationship between customer concentration and manufacturing firm performance. Financing constraints are found to positively moderate the mediating role of trade credit financing in the relationship between customer concentration and firm performance. This research broadens the understanding of the implications of customer relationships on trade credit financing and performance, thereby enriching the knowledge base for managing a firm's financing channels more effectively.

Keywords: customer concentration; firm performance; trade credit financing; financing constraints

1. Introduction

The enhancement of corporate competitiveness through the lens of customer relationship management (CRM) has increasingly become a central area of focus (Cao and Zhang, 2011; Chang et al., 2016; Ataseven and Nair, 2017). As articulated by Haislip and Richardson (2017), the ramifications of CRM on corporate performance are considerable. There is an escalating trend among Chinese manufacturing enterprises to prioritize the incorporation of CRM (Yan et al., 2021). Customer concentration, an essential metric in assessing a corporation's customer relationships, has emerged as a significant tactic in CRM (Ak and Patatoukas, 2015; Qiu, 2018; Zhang et al., 2020). Among the entities listed in the Fortune Global 500, approximately 80% have established supply chain management strategies (Feng and Wei, 2019). For instance, Foxconn, a Global 500 corporation, has adopted a high customer concentration strategy, wherein its top five customers account for 70% of its revenue. Given this perspective on customer concentration, it is intriguing to investigate the mechanisms through which firm performance can be enhanced (Hui et al., 2019).

For an extended duration, corporate managers have contended with the intricate problem of discerning the manner in which customer concentration can catalyze an enhancement in firm performance (Hui et al., 2019). The preponderance of prior

research on customer concentration has inherently zeroed in on its direct effects on a myriad of enterprise facets, including performance, risk, inventory management, financial management, and policy formulation (Irvine et al., 2016; Patatoukas, 2012; Peng et al., 2019; etc.). The existing body of literature has significantly contributed to the realm of supply chain research (Kähkönen, 2015; Liu et al., 2021; Zhang et al., 2021). However, a definitive consensus remains elusive. Importantly, investigations into the repercussions of customer concentration on firm performance have led to divergent conclusions (Campello and Gao, 2017; Huang et al., 2016; Kwak and Kim, 2020; etc.). For instance, both Irvine et al. (2016) and Hui et al. (2018) posit that a firm's dependence on a select cadre of primary customers can dilute its bargaining strength, engendering a negative influence on performance. Conversely, Patatoukas (2012) discovered that customer concentration attenuated costs associated with search and sales in the transactional process, thereby augmenting operational efficiency and profitability. Moreover, a faction of researchers proposed a nonlinear association between customer concentration and firm performance (Kwak and Kim, 2019; Zhou et al., 2019). As such, the exploration of the actual impact of customer concentration on firm performance remains a highly pertinent research subject.

The majority of extant research predominantly utilizes linear regression to scrutinize the correlation between corporate performance and customer concentration, illustrating how customer concentration can either escalate or impede firm performance. However, research exploring the underlying causative pathways between the two remains relatively scant. In current studies examining mediating effects, it is primarily contended that the impact mechanism of customer concentration on firm performance is mediated by decisions associated with the firm's cost structure (Abashi and Kordestani, 2014), operational efficiency (Huan et al., 2017), earnings management (Deng and Yan, 2019), and R&D levels (Kunieda and Takashima, 2023). In terms of moderating variables, factors influencing the relationship between customer concentration and firm performance are scrutinized, with a focus on specific customer investments (Irvine et al., 2016), managerial capabilities (Jin et al., 2022), and industry competition intensity (Han et al., 2023). Minimal research has ventured into the perspective of trade credit financing and financing constraints.

Trade credit financing embodies a form of relationship-based lending within business transactions and serves as a substantial source of funding for corporations (Dou et al., 2019), with the potential to enhance a firm's performance (Fabbri and Menichini, 2010; Hill, 2019). From a transactional perspective, sellers provide trade credit to buyers to curtail transaction costs, ensure product quality, and implement price discrimination (Petersen and Rajan, 1997; Brennan et al., 1988). From a financing standpoint, trade credit financing is occasionally more suitable for fulfilling the financing requirements of enterprises (Dou and Zhu, 2012; Murfin and Njoroge, 2015), thereby reducing financing costs. However, there is an evident dearth of research on whether customer concentration can affect firm performance through the mechanism of trade credit financing. Similarly, it is essential to conduct an in-depth study on whether the degree of financing constraints can moderate the aforementioned mechanisms.

The objective of this research was to identify the variables that exert influence on firm performance and to execute an empirical examination of the correlation between

customer concentration and firm performance. The extant literature has not definitively ascertained the impact of customer concentration on firm performance, with certain viewpoints suggesting a positive correlation (Patatoukas, 2012), while others postulate a contrarian stance (Hui et al., 2019). The majority of studies have neglected the pivotal role of trade credit financing in the relationship between supply chain transactions and firm performance. In addition, previous studies have not distinguished between customer trade credit financing and trade credit financing for the entire supply chain. However, in the context of preserving enduring transactional relationships, the role of trade credit financing is integral. Therefore, we posited trade credit financing as a mediating variable and conducted an empirical analysis of the relationship between customer concentration and firm performance. Moreover, we contemplated the effect of firms' financing constraints on the aforementioned relationship, introducing financing constraints as a moderating variable. We formulated a moderated mediation model to scrutinize the influence of customer concentration on firm performance.

Our research contributes in several distinct facets. Primarily, we provide evidence on the manner in which customer concentration impacts firm performance. By gathering financial data from listed Chinese manufacturing corporations and employing regression analysis, we probe into the effect of customer concentration on firm performance. Does trade credit financing serve as a mediating entity in this relationship? How does financing constraint modulate the influence of customer concentration on trade credit financing? Our investigation extends the probe of factors impacting firm performance, adopting the relatively fresh perspective of customer concentration. Furthermore, in contrast to other studies, we undertake an exploratory examination of the mechanisms via which customer concentration affects firm performance. Finally, informed by the unique operational milieu of Chinese manufacturing enterprises, our research outcomes and insights can offer direction for customer relationship and performance management within Chinese corporations.

The remainder of this paper is structured as follows: Section 2 elucidates the theoretical analysis and research hypotheses. Section 3 details data acquisition and measurement. Section 4 renders an empirical analysis, results, and robustness checks. Section 5 elucidates the conclusion of this paper. Section 6 delineates our contributions.

2. Review of literature

2.1. Customer concentration and firm performance

Prominent customers can exert substantial influence on corporate management decisions and performance (Ak and Patatoukas, 2015; Kim and Zhu, 2018). The exploration of the relationship between the two has predominantly been rooted in transaction cost theory and resource dependence theory. Presently, a debate persists regarding the repercussions of customer concentration on firm performance (Shen et al., 2018; Kwak and Kim, 2020).

Viewed through the lens of transaction cost theory, elevated customer concentration can curtail transaction costs, optimize asset utilization, and augment operational efficiency, thereby exerting a positive influence on firm performance (Patatoukas, 2012; Irvine et al., 2016; Krolikowski and Yuan, 2017). For instance,

Patatoukas (2012) contended that customer concentration attenuates sales expenses, bolsters asset efficiency, and ultimately enhances profitability. Similarly, Chen and Wang (2014) discovered that supply chain integration impacts cost reduction, escalates asset turnover, and improves asset utilization, culminating in an enhancement in a corporation's return on assets and favorable effects on financial performance. Hence, research anchored in transaction cost theory maintains that customer concentration can diminish operational costs, improve business efficiency, and mitigate sales uncertainty (Irvine et al., 2016), all of which are advantageous for augmenting firm performance.

Additionally, certain viewpoints assert that higher customer concentration deepens and stabilizes trust and dependence between a corporation and its key customers, fostering enhanced collaboration through joint investment projects and information sharing, ultimately boosting operational efficiency (Irvine et al., 2016). For example, Panos (2012) examined the relationship between customer concentration and stock market value, unveiling a positive correlation between customer concentration and company stock returns. This suggests that increased customer concentration fortifies mutual understanding with major clients and investors, thereby improving operational efficiency and ultimately escalating company value. Conversely, renowned major clients can positively impact the corporation by enhancing brand recognition, driving enhancements in the production process, promoting technological advancements, and even influencing investments in other projects (Casalin et al., 2017).

Conversely, research that is anchored in the resource dependence theory proffers antithetical viewpoints, suggesting that customer concentration may engender detrimental effects on firm performance. For instance, Dubois et al. (2008) underscore that power disequilibria in collaborative relationships can culminate in uneven distribution of benefits, with the disadvantaged entity suffering losses. The escalation in customer concentration exemplifies the company's dependence on pivotal customers during transactions (Yli-Renko and Janakiraman, 2008). This profound reliance can coerce the company into acceding to stringent conditions imposed by significant customers, inevitably impairing firm performance. Concurrently, being in a comparatively weaker position, the company may forfeit bargaining power, and dominant customers might exert pressure on the company to relinquish more profits, leading to a surge in operational costs (Krolikowski and Yuan, 2017), thereby exerting a negative impact on firm performance.

Indubitably, considerable contention persists in research concerning the relationship between customer concentration and firm performance, grounded in the previously mentioned theories. However, in the context of the prevailing realities of Chinese manufacturing companies, cost control remains a cardinal factor influencing business operations (Zheng et al., 2019). Concurrently, numerous enterprises continue to contend with substantial issues of information asymmetry, where the adverse effects of resource dependence are not the primary concern. To alleviate cost pressures and mitigate the unfavorable effects of information asymmetry, numerous publicly traded Chinese manufacturing companies are earnestly striving to elevate customer concentration (Huan et al., 2017). Given this context, the present study posits the following hypotheses:

H1: Customer concentration positively affects firm performance.

2.2. Customer concentration and trade credit financing

Within the domain of supply chain transactions, academics have conducted extensive exploration into the influence of supply chain concentration on trade credit financing, principally from the standpoint of bargaining power (Burkart and Ellingsen, 2004). Seifert et al. (2013), employing the price discrimination theory as a foundation, propose that trade credit financing embodies preferential and discounted benefits proffered by businesses to their clientele. Petersen and Rajan (1997) explicitly articulate that trade credit policies encompass indirect price differentiation implemented by businesses for their customers. Furthermore, Cunat (2007) postulate that a company's strength is intimately correlated with the trade credit services it renders. Piercy and Lane's (2006) research unveils that when a company boasts robust financial stability, it may be predisposed to impel customers to expedite debt repayment. Fabbri et al. (2008) posit that companies extending trade credit financing for operational motives typically maintain a comparatively weaker market position, culminating in a higher proportion of credit sales. Giannetti et al. (2011) propose that customers might anticipate companies to furnish more trade credit financing when customer concentration is elevated. Fabbri and Klapper (2016) also argue that if a company is a significant customer, amplified dependence will obligate suppliers to provide more trade credit financing. Dass et al. (2015) similarly contend that when customers wield stronger bargaining power, they may make more favorable requests to suppliers, such as escalating credit sales, extending accounts receivable collection periods, and reducing cash sales, thereby inducing companies to provide more trade credit financing to customers. Based on this context, the present study advances the following hypotheses:

H2: Customer concentration negatively affects the trade credit financing that firms receive from their customers.

2.3. Mediation in trade credit financing

As previously underscored, the concentration of a firm's clientele significantly impacts the magnitude of trade credit financing procured from customers (Lee et al., 2018). Grounded in the resource dependence theory (Gulati and Sytch, 2007), an augmentation in customer concentration situates customers in a propitious position within the transactional continuum, potentially predisposing firms towards greater compromise with their larger customers (Fabbri and Klapper, 2016), thereby diminishing the volume of trade credit financing derived from customers.

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 and 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.

Moreover, Molina and Preve (2012), in their empirical study of trade credit financing in customer transactions subject to financing constraints, discerned that trade credit assumes a crucial role in short-term financing. Trade credit financing not only assuages a company's financing constraints but also incentivizes firms to escalate their investments in inventory, fixed assets, and other assets, thereby improving firm performance (Guariglia and Mateut, 2006). Concurrently, Yu's (2013) research, which investigates the impact of trade credit financing on firm growth and the facilitative role of relationship networks in the utilization of trade credit financing, reveals that enterprises employing trade credit financing can mitigate financing constraints and catalyze business growth, a trend particularly apparent for companies with pressing financing needs.

In summary, based on the analysis of the interplay between customer concentration, trade credit financing, and firm performance, it can be discerned that shifts in customer concentration influence the volume of trade credit financing a firm secures, which subsequently impacts its performance. Therefore, this study advances the proposition that trade credit financing serves as a mediating variable in the relationship between customer concentration and firm performance. Based on this premise, the following hypothesis is put forward:

H3: Customer concentration affects firm performance through trade credit financing.

2.4. The moderating role of financial constraint

When the costs associated with external financing significantly exceed those of internal financing, enterprises encounter pronounced financing constraints (Kaplan and Zingales, 1997). Viewed through the lens of supply chain theory, these financing constraints have a direct effect on both the cost of debt capital and the cost of equity capital for businesses (Wang and Liu, 2016; Kang et al., 2017). Kang et al.'s (2017) research unveils a positive association between customer concentration and debt-related expenses. Wang and Liu (2016) findings illustrate a marked escalation in debt costs when customer concentration ascends to a certain threshold. Pertaining to equity capital, Wang and Zhu (2017) contend that customer concentration triggers an amplification in equity capital costs owing to escalated risks, culminating in augmented equity expenses.

With respect to the influence of financing constraints on trade credit financing, Petersen and Rajan (1997) posit that companies grappling with financing constraints frequently resort to alternative financing conduits such as trade credit. Niskanen and Niskanen (2006), conducting empirical research on Finnish enterprises, deduce that financially constrained businesses may perceive trade credit as a viable alternative financing strategy. In a similar vein, Molina and Preve (2012), scrutinizing trade credit financing data spanning 1978 to 2000, unearth that financially distressed companies tend to lean more heavily on trade credit for short-term financing, especially larger-scale enterprises. Martínez-Sola et al. (2013) and Shi et al. (2020) also arrive at congruent conclusions.

Drawing on theories of information asymmetry and resource dependency, the degree of customer concentration in a company bears influence on the magnitude of

trade credit financing it secures from customers. 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. Conversely, when companies are subjected to greater financing constraints, they exhibit a stronger reliance on trade credit for financing. Based on the analysis proffered above, the study advances the following hypothesis:

H4a: Financing constraints moderate the negative impact of customer concentration on trade credit financing.

Integrating Hypotheses 3 and 4a, 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 customer concentration, display a pronounced propensity for external financing, facilitating their procurement of more extensive trade credit financing from customers. Under these conditions, the likelihood that customer concentration impacts 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 customer concentration, their motivation to secure trade credit financing may not be as potent. Consequently, based on this analysis, the impact of customer concentration on trade credit financing is moderated by the extent of financing constraints, which subsequently determines firm performance. Therefore, the subsequent hypothesis is advanced:

H4b: Financing constraints positively moderate the mediating effect of trade credit financing on the relationship between customer concentration and firm performance.

Based on the literature review and argumentation, the conceptual framework of this study is presented in **Figure 1**.

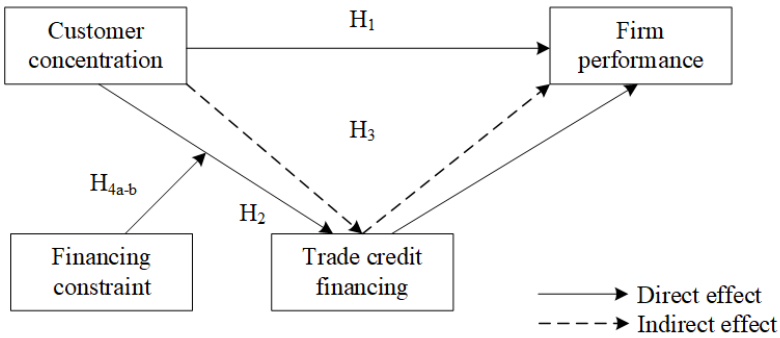

Figure 1. Conceptual framework.

In the present study, the focus is centered on scrutinizing the mechanism by which customer concentration influences corporate performance. The research framework is depicted in **Figure 1**. Four salient issues are addressed in our investigation, including what is the impact of customer concentration on corporate performance in the context of publicly listed companies in the Chinese manufacturing sector (H1), how customer concentration shapes the approach to trade credit financing (H2), whether customer

concentration influences corporate performance through the mediating effect of trade credit financing (H3), and whether the degree of financial constraint exerts a moderating influence (H4a-b).

3. Methodology

3.1. Sample selection and data sources

This investigation initially amassed data from all publicly listed manufacturing corporations in China, spanning the period from 2013 to 2020. This dataset incorporated facets such as customer concentration, operational activities, and financial status, yielding a total of 11,686 firm-year observations. The selection of this timeline was predicated on major revisions to China's accounting framework in 2012 and the mandate from 2013 onwards for all listed companies to disclose data on supply chain relationships, information that had previously been elusive. Moreover, the socio-economic development of China between 2013 and 2020 was relatively stable and was minimally impacted by global factors such as pandemics, military conflicts, and economic crises. The compiled data forms an unbalanced panel dataset. The data underwent a series of treatments: initially, manufacturing companies that were either suspended or delisted during the sample period were expunged. Subsequently, sectors with less than 30 company observations in a given year were eliminated to safeguard statistical significance of the research (Fan, 2001). A total of 7488 observations from six out of China's 14 listed manufacturing industries were selected to constitute the final sample for the investigation. These chosen industries encompass petroleum and chemical products, pharmaceuticals, computer and communication equipment, non-ferrous metal smelting and processing, machinery and equipment, and electrical machinery and equipment. To alleviate potential analysis bias engendered by outliers, a Winsorization technique was applied to all continuous variables by truncating values at the 1st and 99th percentiles, ensuring the robustness of the research findings. Data pertaining to customer concentration and firm performance was primarily sourced from the China Stock Market & Accounting Research Database (CSMAR). Information regarding trade credit financing and capital was extracted from the financial statements of publicly listed enterprises. The indicator for financing constraints was obtained through regression analysis, drawing upon preceding research by Kaplan and Zingales (1997). Detailed particulars of the sample processing are presented in **Table 1**.

Table 1. Population and sampling (companies).

Description	2013	2014	2015	2016	2017	2018	2019	2020	Total
All manufacturing companies listed on Chinese stock exchanges (2013-2020)	1,042	1,107	1,031	1,368	1,604	1,661	1,789	2,084	11,686
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

Table 1. (*Continued*).

Description	2013	2014	2015	2016	2017	2018	2019	2020	Total
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. Missing data Companies	387	218	205	216	302	154	273	389	2144
10. Abnormality financially 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	1,003	1,225	1,248	1,357	7,488
Percentage (%)	45.00	61.80	60.40	64.30	62.50	73.80	69.8	65.10	64.08

3.2. Variable measurement

In the present investigation, the methodological construct for the variables was formulated based on extant research. Concerning the independent variable, we adopted the approach delineated by Hui et al. (2018) and Zhou et al. (2019), wherein customer concentration (CC) is quantified via the ratio of sales revenue generated from the top five customers to the aggregate sales revenue of the firm. The dependent variable employed in the current study is firm performance, ascertained via Return on Assets (ROA) (Uotila et al., 2009; Park et al., 2022). ROA signifies the proportion of a company's profit relative to its mean assets. In our robustness tests, Return on Equity (ROE) is utilized as an alternative gauge of firm performance.

Trade credit financing, which functions as a mediating variable in this investigation, encompasses trade credit relationships established via deferred payments or prepayments during conventional business operations and commodity transactions (Li and Liu, 2016; Dou et al., 2019). TCr denotes the trade credit financing procured by the firm from its clientele and is computed by the discrepancy between the sums of prepaid accounts and accounts receivable divided by the firm's principal business income. In our robustness tests, this study adjusts the variable (TCr) by subtracting the industry median to account for substantial disparities in customer trade credit financing across various industries. Subsequently, we perform a regression analysis to verify robustness.

Financing constraints, serving as a moderating variable in this investigation, are quantified using the Kaplan-Zingales (KZ) index. The KZ index is a composite metric derived by regressing five determinants, including net cash flow from operating activities, cash holdings, cash payment levels, debt levels, and growth, to estimate financing constraints. This method has been extensively utilized in empirical research related to financing constraints (Almeida et al., 2004). In this study, the Kaplan-Zingales (KZ) index, following the methods of Kaplan and Zingales (1997), is employed to quantify the degree of financing constraints for publicly-listed manufacturing firms in China, represented as FC. In our robustness tests, the variable denoting financing constraints (FC) is lagged by one period to yield the lagged financing constraints (LFC).

Guided by the studies of Petersen and Rajan (1997), Fisman and Love (2002), Ge and Qiu (2007), Zhou et al. (2019), the following variables were selected as control

variables in order to mitigate their influence on trade credit financing and enterprise performance. These include the scale of the enterprise (SIZE), the leverage ratio (LEV), Industry (IND), and YEAR. The construct includes six industry dummy variables and eight-year dummy variables to control for the effect of industry and year on the relationship between the variables. A comprehensive account of the variables and their respective measurements are outlined in **Table 2**.

Table 2. Definition and measurement of variables.

Variable	Symbol	Measure	Sources
Independent variables			
Customer concentration	CC	Top five customers sales amount/All sales amount	Hui et al., (2018); Zhou et al., (2019)
Dependent variable			
Firm performance	ROA	Net profit after tax / Total assets	Uotila et al., (2009); Park et al., (2022)
Mediating variable			
Trade credit financing from customers	TCr	(Receivables in advance-Accounts receivable)/Revenue from main business	Li and Liu, (2016); Dou et al., (2019)
Moderating variable			
Financing constraint	FC	Using the methodology of Kaplan and Zingales (1997), a regression model based on five financial indicators was used to estimate a KZ index representing the degree of financing constraints	Kaplan and Zingales (1997)
Control variables			
Firm size	SIZE	Natural logarithm of total assets at the end of the period	Petersen and Rajan (1997); Baysinger and Hoskisson (1989); Graves and Langowitz (2006); Liao et al., (2016); Sasidharan et al., (2015)
Financial leverage	LEV	Year-end liabilities/Year-end assets	Zhou et al., (2019)
Industry	IND	Industry dummy variables (1–6)	
Year	YEAR	Year dummy variables (2013–2020)	

3.3. Model

In order to test the hypotheses, the following model was set up in this study.

$$\mathrm{ROA}=\alpha_{10}+\alpha_{11}CC+\alpha_{12}SIZE+\alpha_{13}LEV+Year+Ind+\varepsilon_1 \quad (1)$$

$$TCr=\alpha_{20}+\alpha_{21}CC+\alpha_{22}SIZE+\alpha_{23}LEV+Year+Ind+\varepsilon_2 \quad (2)$$

$$\mathrm{ROA}=\alpha_{30}+\alpha_{31}TC_r+\alpha_{32}SIZE+\alpha_{33}LEV+Year+Ind+\varepsilon_4 \quad (3)$$

$$\mathrm{ROA}=\alpha_{40}+\alpha_{41}CC+\alpha_{42}TC_r+\alpha_{43}SIZE+\alpha_{44}LEV+Year+Ind+\varepsilon_4 \quad (4)$$

$$TCr=\alpha_{50}+\alpha_{51}\mathrm{CC}+\alpha_{52}FC+\alpha_{53}CC*FC+\alpha_{54}SIZE+\alpha_{55}LEV+Year+Ind+\varepsilon_5 \quad (5)$$

$$\mathrm{ROA}=\alpha_{61}+\alpha_{62}CC+\alpha_{6_3}\mathrm{FC}+\alpha_{64}\mathrm{CC}*\mathrm{FC}+\alpha_{65}\mathrm{TC}_r+\alpha_{66}SIZE+\alpha_{67}LEV+Year+Ind+\varepsilon_6 \quad (6)$$

In the equations under consideration, the variable CC symbolizes customer concentration (the independent variable); ROA denotes firm performance (the dependent variable); TCr represents trade credit financing from customers (the mediating variable); FC stands for financing constraints

(the moderating variable); SIZE and LEV are control variables, while Year and Ind signify year and industry dummy variables. In line with the sequential mediation testing methodology recommended by Judd and Kenny (1981), Baron and Kenny (1986), Wen et al. (2004), Hayes and Preacher (2010), and Wen and Ye (2014), we validated the mediating role of trade credit financing (TCr). When the regression coefficients α_{11}, α_{21}, and α_{31} in models (1)-(3) exhibit significant deviation from zero, and if the coefficient α_{42} in model (4) is also significant, we can establish the existence of TCr's mediating effect.

Additionally, we followed the paradigm proposed by Korsgaard et al. (2002), Langfred (2004), and Muller et al. (2005) to elucidate a moderated mediation setting. In model (5), if the regression coefficient α_{53} for CC*FC (The cross-multiplier term between customer concentration and financing constraint) significantly deviates from zero, it permits us to deduce that FC exerts a moderating influence on the link between CC and TCr. In model (6), when both the regression coefficients α_{64} for CC*FC and α_{65} for TCr are statistically significant, we can establish that FC moderates the mediating impact of TCr.

4. Results

4.1. Correlation analysis and descriptive statistical analysis

The Pearson correlation coefficient is a widely employed metric to evaluate the degree of correlation between two variables. In this study, Table 3 presents Pearson's correlation coefficients to scrutinize the relationships among the variables. It can be discerned that all the correlation coefficients in the table are below 0.65, which suggests that there is no severe issue of multicollinearity among the variables (Farrar and Glauber, 1967).

As depicted in Table 3, the descriptive statistics indicate that the average customer concentration of publicly-listed manufacturing companies in China is roughly 32.45, with a minimum of 5.22, a maximum of 90.22, and a standard deviation of 18.9, signifying substantial variation in companies' customer concentration. Pertaining to trade credit financing, the mean and median values for trade credit financing procured from customers are −0.26 and −0.23, respectively, both of which are negative. This intimates that Chinese manufacturing firms are more inclined to provide trade credit financing in their transactions with large customers than to receive it. This reflects the buyer's market characteristics, where companies generally negotiate from a weaker position when dealing with customers. In terms of firm performance (ROA), the mean is 0.05, with a minimum of −0.22 and a maximum of 0.23, emphasizing significant disparities in firm performance. Further, the mean of the financing constraints index (FC) for publicly listed manufacturing companies is 0.68, ranging from −5.22 to 4.79, suggesting that financing

constraints are pervasive among these companies.

Table 3. Correlation matrix and descriptive statistics.

Variables/statistics	1	2	3	4	5	6
(1) CC	1.00					
(2) ROA	−0.026*	1.00				
(3) TCr	−0.155*	0.167*	1.00			
(4) FC	0.01	−0.565*	−0.182*	1.00		
(5) LEV	−0.022*	−0.362*	0.053*	0.614*	1.00	
(6) SIZE	−0.156*	−0.050*	0.212*	0.183*	0.535*	1.00
VIF	1.11	-	1.26	1.87	2.44	1.60
N	7,488	7,488	7,488	7,488	7,488	7,488
Min	5.22	−0.22	−1.10	−5.22	0.06	20.01
Max	90.22	0.23	0.18	4.79	0.87	25.62
Mean	32.45	0.05	−0.26	0.68	0.39	22.08
Median	27.89	0.04	−0.23	0.91	0.38	21.94
SD	18.96	0.05	0.20	1.80	0.18	1.08
Skewness	0.83	−0.36	−1.05	−0.65	0.22	0.68
Kurtosis	−0.05	3.02	1.40	0.26	−0.71	0.17

* Correlation is significant at 0.05.

4.2. Hypothesis testing

The Hausman test results for Models 1-6 indicate that all *p*-values are below 0.05, supporting the use of a fixed-effects model for regression estimation. 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).

Table 4. Hausman test results.

	Model 1 (ROA)	Model 2 (TCr)	Model 3 (ROA)	Model 4 (ROA)	Model 5 (TCr)	Model 6 (ROA)
Hausman test (chi2)	74.75	142.56	42.69	73.05	95.08	63.69
p-value	0.000	0.000	0.000	0.000	0.000	0.000
Fixed or random effect model	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed

Model 1 is utilized to evaluate Hypothesis H1, employing multiple linear regression and fixed effects models to examine the influence of customer concentration on firm performance. The outcomes of the analysis are delineated in **Table 5**. The findings demonstrate that the regression coefficient of customer concentration is 0.0003 and is statistically significant at the 0.05 level. This signifies that the independent variable, customer concentration (CC), exerts a significant positive impact on the dependent variable, firm performance (ROA). Additionally, both the company size and the leverage coefficient are significant at the 0.05 significance level. Thus, Hypothesis 1 is substantiated. The regression outcomes suggest that elevated customer concentration implies a progressive deepening and

stabilization of mutual trust and interdependence between the company and its principal customers. Prominent customers are more inclined to intensify cooperation with the company, thereby reducing transaction costs and enhancing the company's operational efficiency (Irvine et al., 2016), which positively impacts firm performance.

In **Table 5**, the outcomes of Model 2 are utilized to analyze the impact of customer concentration on trade credit financing from customers. The results reveal that the regression coefficient of customer concentration is -0.0007 and is statistically significant at the 0.05 level, indicating that customer concentration (CC) has a significant negative effect on trade credit financing from customers (TCr). Hypothesis 2 is thus substantiated. This aligns with the findings of Dass et al. (2015) and Fabbri and Klapper (2016). The regression results suggest that when customer concentration is high, the company's dependence on customers is robust, and the company possesses relatively weak bargaining power over customers. Customers may demand increased trade credit facilities and extended payment terms from the company, culminating in diminished trade credit financing procured from customers.

In the analysis outcomes of Model 3, the regression coefficient of customer trade credit financing is 0.0592 and is statistically significant at the 0.05 level, signifying that there is a substantial positive effect of customer trade credit financing (TCr) on firm performance (ROA). This is congruent with the findings of Su (2012). Hypothesis 3 is thus substantiated. The more trade credit financing a company secures from customers, the more funds it can raise from major customers without incurring costs. With more accessible funds, the company can augment its investments, thereby enhancing firm performance.

In Model 4, both customer trade credit financing (TCr) and customer concentration (CC) are incorporated into the regression model to predict firm performance (ROA). As delineated in the regression outcomes in Table 5, the coefficient for customer trade credit financing is 0.0590 and is statistically significant at the 0.05 level. By amalgamating the results of Hypotheses 1-3 and adhering to the mediation effect judgment methodology proposed by Wen et al. (2004) and Hayes and Preacher (2010), the findings suggest that trade credit financing from customers partially mediates the impact of customer concentration on firm performance. Additionally, the Sobel mediation effect test is passed, corroborating Hypothesis 3.

Model 5 is employed to analyze whether financing constraints influence the impact of customer concentration on trade credit financing from customers. As per the regression outcomes in Table 6, the coefficient of the interaction term (CC*FC) between customer concentration (CC) and financing constraints (FC) is 0.0002 and has a significant positive effect on trade credit financing from customers (TCr) at the 0.05 level. Additionally, CC has a significant negative impact on TCr at the 0.05 significance level. This leads us to deduce that financing constraints positively moderate the negative impact of customer concentration on trade credit financing from customers, which is congruent with the findings of Wang and Liu, (2016), Kang et al. (2017), and Wang and Zhu (2017). In essence, as the value of the moderating variable escalates, the negative impact of customer concentration on trade credit financing from customers diminishes, and financing constraints attenuate the negative impact of customer concentration on trade credit financing. Hypothesis 4a is thus validated.

In **Table 6**, the outcomes of Model 6 reveal that customer concentration (CC) and customer trade credit financing (TCr) are significant at the 0.05 level, affirming the mediating effect of TCr. Additionally, the interaction term (CC*FC) between customer concentration (CC) and financing constraint (FC) is significantly positive at the 0.05 level. Upon comparing the regression results of Model 4, the coefficient of TCr is significantly smaller, indicating the existence of a moderating mediating effect. In other words, the moderating variable FC exerts varying effects on the mediating variable TCr at different levels. Given the same sign of the coefficients of customer concentration (CC) and customer trade credit financing (TCr) in the presence of the interaction term (CC*FC), as per Fan's determination method (2001), this suggests that financing constraints positively moderate the mediating effect of trade credit financing on the relationship between customer concentration and firm performance. Hypothesis 4b is thus established.

Table 5. Results of hypothesis testing (Model 1–Model 4).

Variables	Model 1			Model 2			Model 3			Model 4		
	ROA			TCr			ROA			ROA		
	β	*t*-stat	*p*-value	β	*t*-stat	*p*-value	β	*t*-stat	*p*-value	β	*t*-stat	*p*-value
Constant	−0.202*	−3.84	0.000	−1.021*	−10.06	0.000	−0.193*	−3.86	0.000	−0.210*	−4.23	0.000
CC	0.0003*	4.3	0.000	−0.0007*	−3.62	0.004				0.0003*	4.25	0.000
TCr							0.0592*	9.3	0.000	0.0590*	9.29	0.000
LEV	−0.112*	−11.88	0.000	−0.0613*	−2.12	0.034	−0.112*	−12.08	0.000	−0.1130*	−12.14	0.000
SIZE	0.0135*	5.56	0.000	0.0422*	8.87	0.000	0.0141*	6.11	0.000	0.0145*	6.3	0.000
IND	Yes			Yes			Yes			Yes		
YEAR	Yes			Yes			Yes			Yes		
N	7,488			7,488			7,488			7,488		
R-squared	0.139			0.148			0.152			0.1512		
F-stat	17.00*			27.65*			22.83*			22.13*		
(F-stat sig)	(0.000)			(0.000)			(0.000)			(0.000)		
Durbin-Watson	2.017			1.992			1.915			2.016		
Sobel Test (Z value)										−4.691*		

* Represents significant at 0.05.
Note: CC = customer concentration, TCr = trade credit financing in customer transactions, ROA = Financial performance, SIZE = the logarithm of the firm total assets, LEV = leverage, IND = Industry dummy variables, YEAR = Year dummy variables.

Table 6. Results of hypothesis testing (Model 5–Model 6).

Variables	Model 5			Model 6		
	TCr			ROA		
	β	*t*-stat	*p*-value	β	*t*-stat	*p*-value
Constant	−0.895*	−9.3	0.000	−0.1148*	−2.46	0.014
CC	−0.0007*	−3.05	0.002	0.0003*	3.7	0.000
TCr				0.0448*	7.49	0.000
FC	−0.0346*	−14.6	0.000	−0.0081*	−15.12	0.000
CC*FC	0.0002*	2.49	0.013	0.0001*	2.05	0.041
LEV	0.193*	5.74	0.000	−0.0602*	−6.73	0.000
SIZE	0.0306*	6.61	0.000	−0.0092*	4.26	0.000
IND	Yes			Yes		
YEAR	Yes			Yes		
N	7,488			7,488		
R-squared	0.204			0.1524		
F-stat	37.25*			29.21*		
(F-stat sig)	0.000			0.000		
Durbin-Watson	1.985			2.021		

* Represents significant at 0.05.
Note: CC = customer concentration, TCr = trade credit financing in customer transactions, ROA = Financial performance, FC = Financing constraints, CC*FC = Cross-multiplier terms for customer concentration and financing constraints, SIZE = the logarithm of the firm total assets, LEV = leverage, IND = Industry dummy variables, YEAR = Year dummy variables.

4.3. Robustness testing

Four robustness tests are instituted in this study to affirm the validity of the findings. Initially, to comprehend and control the variation in firm performance within industries, the study adjusts the firm performance in the manufacturing sector by deducting the industry median, thereby attenuating the effects attributable to industry-specific factors. This industry-adjusted firm performance is symbolized as ROA_a. The outcomes of the regression analysis are presented in Model 1 of **Table 7**, and it can be discerned that the primary conclusions sustain their validity.

Subsequently, the study accounted for the pronounced discrepancies in customer trade credit financing across different industries by subtracting the industry median and executing a regression analysis to ascertain the robustness of the results. The adjusted customer trade credit financing, which takes into account industry effects, is designated as TCr_a. The outcomes of the regression analysis are depicted in Model 2 of Table 7, and it is noteworthy to mention that the primary conclusions remain in concordance with the initial findings.

In the third measure, the study adopts return on equity (ROE) as a surrogate variable to appraise firm performance. ROE is indicative of the

proportion of a firm's net income relative to its mean equity. The findings from the regression analysis are displayed in Models 3 and 4 of Table 7, and it is evident that the primary conclusions persist in their validity.

Lastly, the robustness test aims at evaluating the influence of financing constraints on the relationship between customer concentration, trade credit financing, and firm performance necessitate the lagging of financing constraints (FC) by one period to compute the lagged financing constraints (LFC). Subsequently, LFC and the interaction term CC*LFC (Customer concentration and cross-multiplier term for lagged one-period financing constraints) are incorporated into the regression model for evaluation. The outcomes, as outlined in Models 5 and 6 of **Table 8**, are in harmony with the central findings of the study.

Table 7. Results of robustness tests (Model 1–Model 4).

Variables	Model 1			Model 2			Model 3			Model 4		
	ROA_a			TCr_a			ROE			ROE		
	β	***t*-stat**	***p*-value**	***β***	***t*-stat**	***p*-value**	***β***	***t*-stat**	***p*-value**	***β***	***t*-stat**	***p*-value**
Constant	−0.2512*	−4.78	0.000	−0.9226*	−9.1	0.000	−0.5071*	−5.04	0.000	−0.535*	−5.32	0.000
CC	0.0003*	4.08	0.000	−0.0007*	−2.92	0.004				0.0005*	3.6	0.000
TCr							0.1066*	8.11	0.000	0.106*	8.09	0.000
LEV	−0.106*	−11.21	0.000	−0.0615*	−2.13	0.033	−0.1488*	−7.84	0.000	−0.148*	−7.85	0.000
SIZE	0.0135*	5.55	0.000	0.0423*	8.9	0.000	0.0317*	6.79	0.000	0.032*	6.94	0.000
IND	Yes			Yes			Yes			Yes		
YEAR	Yes			Yes			Yes			Yes		
N	7,488			7,488			7,488			5,422		
R-squared	0.095			0.056			0.062			0.065		
F-stat	18.06*			8.46*			14.6*			14.26*		
(F-stat sig)	0.000			0.000			0.000			0.000		
Sobel Test (Z value)										−4.638*		

* Represents significant at 0.05.

Note: CC = customer concentration, ROA_a = firm performance-medianROA (IND), TCr_a = trade credit financing in customer transactions-medianTCr (IND), ROE = return on equity, SIZE = the logarithm of the firm total assets, LEV = leverage, IND = Industry dummy variables, YEAR = Year dummy variables.

Table 8. Results of robustness tests (Model 5–Model 6).

Variables	Model 5			Model 6		
	TCr			ROA		
	β	*t*-stat	*p*-value	β	*t*-stat	*p*-value
Constant	–0.9739*	−9.26	0.000	−0.048*	−2.54	0.011
CC	−0.0008*	−3.14	0.002	0.0001	1.88	0.060
TCr				0.038*	9.46	0.000
LFC	−0.0343*	−7.53	0.000	−0.0086*	−11.28	0.000
CC*LFC	0.0002*	1.96	0.059	0.0001*	2.12	0.034
LEV	0.1286*	3.53	0.000	−0.082*	−14.15	0.000
SIZE	0.0353*	7.02	0.000	0.0067*	7.45	0.000
IND	Yes			Yes		
YEAR	Yes			Yes		
N	5,422			5,422		
R-squared	0.1919			0.0964		
F-stat	6.46*			14.45*		
(F-stat sig)	(0.000)			(0.000)		

* Represents significant at 0.05.
Note: CC = customer concentration, TCr = trade credit financing in customer transactions, LFC = Financing constraints with one-year lag, CC*FC = Cross-multiplier terms for customer concentration and LFC, SIZE = the logarithm of the firm total assets, LEV = leverage, IND = Industry dummy variables, YEAR = Year dummy variables.

5. Conclusion and discussion

This research conducts an empirical investigation into the interplay among customer concentration, trade credit financing, corporate performance, and financing constraints, utilizing data procured from Chinese manufacturing companies listed publicly. Following meticulous empirical scrutiny, four central revelations are discerned. Firstly, within the realm of Chinese publicly listed manufacturing entities, customer concentration exhibits a positive influence on corporate performance. This outcome underscores the significance of contemplating the dependency on customers within supply chain transactions, drawing upon the resource dependency theory and transaction cost theory. Concurrently, the conclusions drawn from this study bear affirmation to prior research undertaken by Patatoukas (2012), Irvine et al. (2016), and Krolikowski and Yuan (2017). Enhanced customer concentration can diminish uncertainty in sales, curtail transaction costs (Panos, 2012), nurture intimate collaboration with principal customers, thereby augmenting operational efficiency (Irvine et al., 2016), and ultimately exerting a positive impact on corporate performance. Enterprises can dynamically modulate customer concentration predicated on their transactional relationships. For instance, when a company's customer concentration is minimal, management can strategically fortify alliances with key customers, thereby positively shaping the company's financial performance. Investors should also meticulously monitor alterations in the company's customer concentration, recalibrating investment strategies in accordance with the positive

influence of amplified customer concentration on corporate performance whilst assessing risk parameters.

Secondly, customer concentration can exert a detrimental influence on customer trade credit financing. The empirical outcomes of this investigation substantiate the notion that an escalation in customer concentration precipitates an over-reliance on key customers and a decline in core bargaining power (Giannetti et al., 2011; Li and Liu, 2016). Chinese manufacturing entities frequently gravitate towards customer-centric strategies and operational policies. In enduring transactions with major clients, companies may necessitate offering more concessions to customers, such as protracted payment terms, augmented accounts receivable, and reduced prepayments, culminating in a decrease in trade credit financing for the company. This mandates that business managers vigilantly monitor the risks associated with customer concentration, promptly adjust customer relationship structures, and alleviate the negative repercussions of customer concentration on trade credit financing.

Moreover, customer concentration can exert a detrimental influence on customer trade credit financing. The empirical results of this investigation endorse the hypothesis that an escalation in customer concentration triggers an over-reliance on key customers and a decline in core bargaining power (Giannetti et al., 2011; Li and Liu, 2016). Chinese manufacturing entities frequently employ customer-centric strategies and operational directives. In enduring transactions with principal clients, companies may find themselves compelled to provide additional concessions, such as protracted payment terms, augmented accounts receivable, and diminished prepayments, culminating in a contraction in trade credit financing for the entity. This highlights the imperative for business managers to vigilantly monitor the risks associated with customer concentration, promptly recalibrate customer relationship structures, and alleviate the negative repercussions of customer concentration on trade credit financing.

Furthermore, the research uncovers that customer concentration influences corporate performance via the mediation of customer trade credit financing. The degree of customer concentration within a business operation exerts an influence on the trade credit financing secured from customers (Fabbri and Klapper, 2016; Lee et al., 2018). These low-cost or even cost-free forms of trade credit financing can curtail corporate expenditures and augment profits (Su, 2012). In essence, trade credit financing serves as a mediator in the impact of customer concentration on corporate performance. Business managers and shareholders can bolster corporate performance by optimizing customer concentration, instituting effective communication mechanisms with key clients to access more trade credit financing and, consequently, enhancing overall corporate performance.

Finally, the research outcomes evince that financing constraints can modulate the relationship between customer concentration and trade credit financing from customers. When companies grapple with heightened financing constraints, they rely more heavily on trade credit for financing (Martínez-Sola et al., 2013; Shi et al., 2020). Thus, financing constraints attenuate the negative impact of customer concentration on trade credit financing. Moreover, the study results suggest that the mediating effect of trade credit financing from customers is contingent on financing constraints. Elevated financing constraints impel firms with higher customer concentration to

obtain more trade credit financing from customers. In such scenarios, the probability that customer concentration influences firm performance via trade credit financing amplifies. On the contrary, firms with lower financing constraints depend more on internal financing and exhibit less motivation to acquire trade credit financing. In accordance with Fan's (2001) judgement method, financing constraints positively moderate the mediating effect of trade credit financing on the relationship between customer concentration and firm performance. This conclusion underscores the importance for business managers and shareholders to establish effective coordination and communication mechanisms with key clients. Timely communication not only mitigates the negative impact of information asymmetry but also aids companies in securing more trade credit financing and enhancing its utilization.

6. Contributions

This study introduces significant advancements to the extant literature in two principal ways. Primarily, this research amplifies the understanding of the mechanisms by which customer concentration influences firm performance. We posit that customer concentration affects a firm's trade credit financing, which subsequently impacts firm performance, with trade credit financing serving as a mediating variable. Predominant research has largely centered on the beneficial impacts of customer concentration on firm performance, such as curtailing transaction costs (Krolikowski and Yuan, 2017), mitigating information asymmetry (Irvine et al., 2016), and enhancing production processes and product technology (Casalin et al., 2017). By integrating trade credit financing as a crucial component in our research, we augment the comprehension of the mechanisms underpinning how customer concentration affects firm performance. Secondarily, this research introduces the variable of financing constraints into our model to scrutinize its moderating effect on the relationship among customer concentration, trade credit financing, and firm performance. While some antecedent studies have probed the connections among supply chain concentration, trade credit financing, and financing constraints (Niskanen and Niskanen, 2006), these works have frequently underscored the identification of alternative financing sources. The notion of financing constraints has infrequently been contemplated as a moderating variable. The outcomes of this research contribute to the enrichment of the literature within this specific research domain.

The practical implications of this research reside in its capacity to aid corporate marketing departments and upper management in devising rational transaction policies, customer relationship management strategies, and supply chain strategies. This research can offer invaluable insights for marketing departments to efficaciously manage supply chain trade relationships and enhance collaboration with customers. Adjusting the degree of customer relationship proximity in a timely manner predicated on the company's situation can augment trade credit financing from customers, thereby promoting an overall enhancement in company performance. Moreover, expanding financing options and attenuating financing constraints can also facilitate obtaining more trade credit financing from customers. Additionally, this research proffers valuable references for senior management in formulating suitable supply chain strategies. By achieving optimal customer concentration and implementing robust

operational strategies, companies should improve trade credit financing, allowing them to effectively allocate funds for other investments, such as business expansion and augmenting research and development investments, ultimately bolstering firm performance.

This study also proffers potential trajectories for future research. Investigating the repercussions of related party transactions on firm performance in supply chains may offer valuable insights (Shin and Lee, 2022). Furthermore, concentrating on specific segments of the manufacturing industry could amplify the depth and breadth of ensuing research.

Author contributions: Conceptualization, KD and MQ; methodology, NT; software, MQ; validation, NT and KD; formal analysis, MQ; investigation, MQ; resources, KD; data curation, KD; writing—original draft preparation, MQ; writing—review and editing, KD; supervision, NT; project administration, MQ; funding acquisition, MQ. All authors have read and agreed to the published version of the manuscript.

Acknowledgments: The authors thank the Humanities and Social Sciences Project of Anhui University, China (Grant No. 2022AH051291) and the Humanities and Social Sciences Key Research Project of Fuyang Normal University (Grant No. 2021FSSK01ZD; No. 2022JYXM0014) for funding this study.

Conflict of interest: The authors declare no conflict of interest.

References

Ak, B. K., and Patatoukas, P. N. (2015). Customer-Base Concentration and Inventory Efficiencies: Evidence from the Manufacturing Sector. Production and Operations Management, 25(2), 258–272. Portico. https://doi.org/10.1111/poms.12417

Almeida, H., Campello, M., and Weisbach, M. S. (2004). The Cash Flow Sensitivity of Cash. The Journal of Finance, 59(4), 1777–1804. Portico. https://doi.org/10.1111/j.1540-6261.2004.00679.x

Ataseven, C., and Nair, A. (2017). Assessment of supply chain integration and performance relationships: A meta-analytic investigation of the literature. International Journal of Production Economics, 185, 252–265. https://doi.org/10.1016/j.ijpe.2017.01.007

Baron, R. M., and Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. Journal of Personality and Social Psychology, 51(6), 1173–1182. https://doi.org/10.1037/0022-3514.51.6.1173

Brennan, M. J., Maksimovics, V., and Zechner, J. (1988). Vendor Financing. The Journal of Finance, 43(5), 1127–1141. Portico. https://doi.org/10.1111/j.1540-6261.1988.tb03960.x

Burkart, M., and Ellingsen, T. (2004). In-Kind Finance: A Theory of Trade Credit. American Economic Review, 94(3), 569–590. https://doi.org/10.1257/0002828041464579

Campello, M., and Gao, J. (2017). Customer concentration and loan contract terms. Journal of Financial Economics, 123(1), 108–136. https://doi.org/10.1016/j.jfineco.2016.03.010

Cao, M., and Zhang, Q. (2010). Supply chain collaboration: Impact on collaborative advantage and firm performance. Journal of Operations Management, 29(3), 163–180. Portico. https://doi.org/10.1016/j.jom.2010.12.008

Casalin, F., Pang, G., Maioli, S., and Cao, T. (2017). Inventories and the concentration of suppliers and customers: Evidence from the Chinese manufacturing sector. International Journal of Production Economics, 193, 148–159. https://doi.org/10.1016/j.ijpe.2017.07.010

Chang, W., Ellinger, A. E., Kim, K. (Kate), and Franke, G. R. (2016). Supply chain integration and firm financial performance: A meta-analysis of positional advantage mediation and moderating factors. European Management Journal, 34(3), 282–295. https://doi.org/10.1016/j.emj.2015.11.008

Cuñat, V. (2006). Trade Credit: Suppliers as Debt Collectors and Insurance Providers. Review of Financial Studies, 20(2), 491–527. https://doi.org/10.1093/rfs/hhl015

Dass, N., Kale, J. R., and Nanda, V. (2014). Trade Credit, Relationship-specific Investment, and Product Market Power*. Review of Finance, 19(5), 1867–1923. https://doi.org/10.1093/rof/rfu038

Deng, M., and Yan, Y. (2019). Do Suppliers Benefit from Customer Concentration: Evidence from Real Earnings Management. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.3444688

Dubois, A., and Fredriksson, P. (2008). Cooperating and competing in supply networks: Making sense of a triadic sourcing strategy. Journal of Purchasing and Supply Management, 14(3), 170–179. https://doi.org/10.1016/j.pursup.2008.05.002

Fabbri, D., and Klapper, L. F. (2016). Bargaining power and trade credit. Journal of Corporate Finance, 41, 66–80. https://doi.org/10.1016/j.jcorpfin.2016.07.001

Fabbri, D., and Menichini, A. M. C. (2010). Trade credit, collateral liquidation, and borrowing constraints. Journal of Financial Economics, 96(3), 413–432. https://doi.org/10.1016/j.jfineco.2010.02.010

Fabbri, D., and Klapper, L. (2008). Market Power And The Matching Of Trade Credit Terms. In Policy Research Working Papers. The World Bank. https://doi.org/10.1596/1813-9450-4754

Fan, X. (2001). Statistical Significance and Effect Size in Education Research: Two Sides of a Coin. The Journal of Educational Research, 94(5), 275–282. https://doi.org/10.1080/00220670109598763

Farrar, D. E., and Glauber, R. R. (1967). Multicollinearity in Regression Analysis: The Problem Revisited. The Review of Economics and Statistics, 49(1), 92. https://doi.org/10.2307/1937887

Feng, H., and Wei, J. J. (2019). Exploring the interplay between social control and supply chain integration, mediated by dependency and information sharing capability. Loka Management Review, (3), 175-192.

Ferris, J. S. (1981). A Transactions Theory of Trade Credit Use. The Quarterly Journal of Economics, 96(2), 243. https://doi.org/10.2307/1882390

Fisman, R., and Love, I. (2003). Trade Credit, Financial Intermediary Development, and Industry Growth. The Journal of Finance, 58(1), 353–374. Portico. https://doi.org/10.1111/1540-6261.00527

Ge, Y., and Qiu, J. (2007). Financial development, bank discrimination and trade credit. Journal of Banking and Finance, 31(2), 513–530. https://doi.org/10.1016/j.jbankfin.2006.07.009

Giannetti, M., Burkart, M., and Ellingsen, T. (2008). What You Sell Is What You Lend? Explaining Trade Credit Contracts. Review of Financial Studies, 24(4), 1261–1298. https://doi.org/10.1093/rfs/hhn096

Guariglia, A., and Mateut, S. (2006). Credit channel, trade credit channel, and inventory investment: Evidence from a panel of UK firms. Journal of Banking and Finance, 30(10), 2835–2856. https://doi.org/10.1016/j.jbankfin.2005.11.002

Gulati, R., and Sytch, M. (2007). Dependence Asymmetry and Joint Dependence in Interorganizational Relationships: Effects of Embeddedness on a Manufacturer's Performance in Procurement Relationships. Administrative Science Quarterly, 52(1), 32–69. https://doi.org/10.2189/asqu.52.1.32

Haislip, J. Z., and Richardson, V. J. (2017). The effect of Customer Relationship Management systems on firm performance. International Journal of Accounting Information Systems, 27, 16–29. https://doi.org/10.1016/j.accinf.2017.09.003

Han, Z., Yu, C., Li, Y., Shi, J., and Liu, Y. (2023). Customer concentration and supplier financial performance: An inverted U-shaped relationship. Industrial Marketing Management, 113, 138–152. https://doi.org/10.1016/j.indmarman.2023.06.003

Hayes, A. F., and Preacher, K. J. (2010). Quantifying and Testing Indirect Effects in Simple Mediation Models When the Constituent Paths Are Nonlinear. Multivariate Behavioral Research, 45(4), 627–660. https://doi.org/10.1080/00273171.2010.498290

Hill, M., Hill, K., Preve, L., and Sarria-Allende, V. (2019). International evidence on the determinants of trade credit provision. Managerial Finance, 45(4), 484–498. https://doi.org/10.1108/mf-07-2018-0295

Huan, L., Gaoping, Z., and Dan, L. (2017). Do big customers influence listed firms' performance? Based on supplier–customer relationships in China. China Journal of Accounting Studies, 5(3), 326–343. https://doi.org/10.1080/21697213.2017.1385158

Huang, H. H., Lobo, G. J., Wang, C., and Xie, H. (2016). Customer concentration and corporate tax avoidance. Journal of Banking and Finance, 72, 184–200. https://doi.org/10.1016/j.jbankfin.2016.07.018Huang, H., Sun, Y., and Chu, Q. (2022). Can we-media information disclosure drive listed companies' innovation? From the perspective of financing constraints. *China Finance Review International*, 12(3), 477-495. doi: 10.1108/CFRI-09-2020-0127

Hui, K. W., Liang, C., and Yeung, P. E. (2018). The effect of major customer concentration on firm profitability: competitive or collaborative? Review of Accounting Studies, 24(1), 189–229. https://doi.org/10.1007/s11142-018-9469-8

Irvine, P. J., Park, S. S., and Yıldızhan, Ç. (2015). Customer-Base Concentration, Profitability, and the Relationship Life Cycle. The Accounting Review, 91(3), 883–906. https://doi.org/10.2308/accr-51246

Jin, G., Jiang, Q., and Liu, X. (2022). Customer Concentration, Managerial Ability, and Corporate Performance. Frontiers in Psychology, 12. https://doi.org/10.3389/fpsyg.2021.814646

Judd, C. M., and Kenny, D. A. (1981). Process Analysis. Evaluation Review, 5(5), 602–619. https://doi.org/10.1177/0193841x8100500502

Kähkönen, A. K. (2015). The context-dependency of buyer-supplier power. International Journal of Procurement Management, 8(4), 396. https://doi.org/10.1504/ijpm.2015.070739

Kang, T., Lobo, G. J., and Wolfe, M. C. (2016). Accounting Conservatism and Firm Growth Financed by External Debt. Journal of Accounting, Auditing and Finance, 32(2), 182–208. https://doi.org/10.1177/0148558x15585236

Kaplan, S. N., and Zingales, L. (1997). Do Investment-Cash Flow Sensitivities Provide Useful Measures of Financing Constraints? The Quarterly Journal of Economics, 112(1), 169–215. https://doi.org/10.1162/003355397555163

Kim, D., and Zhu, P. (2018). Supplier dependence and R&D intensity: The moderating role of network centrality and interconnectedness. Journal of Operations Management, 64(1), 7–18. Portico. https://doi.org/10.1016/j.jom.2018.11.002

Krosgaard, M. A., Brodt, S. E., and Whitener, E. M. (2002). Trust in the face of conflict: The role of managerial trustworthy behavior and organizational context. Journal of Applied Psychology, 87(2), 312–319. https://doi.org/10.1037/0021-9010.87.2.312

Krolikowski, M., and Yuan, X. (2017). Friend or foe: Customer-supplier relationships and innovation. Journal of Business Research, 78, 53–68. https://doi.org/10.1016/j.jbusres.2017.04.023

Kunieda, Y., & Takashima, K. (2023). The effect of customer-base concentration on the relationship between patents and financial performance. Journal of Strategy and Management. https://doi.org/10.1108/jsma-06-2023-0141

Kwak, K., and Kim, N. (2020). Concentrate or disperse? The relationship between major customer concentration and supplier profitability and the moderating role of insider ownership. Journal of Business Research, 109, 648–658. https://doi.org/10.1016/j.jbusres.2019.09.033

Langfred, C. W. (2004). too much of a good thing? Negative effects of high trust and individual autonomy in self-managing teams. Academy of Management Journal, 47(3), 385–399. https://doi.org/10.2307/20159588

Lee, H. H., Zhou, J., and Wang, J. (2018). Trade Credit Financing Under Competition and Its Impact on Firm Performance in Supply Chains. Manufacturing and Service Operations Management, 20(1), 36–52. https://doi.org/10.1287/msom.2017.0640

Li, R. S., and Liu, H. X. (2016). Supply chain relations and Trade Credit Financing: Competition or Cooperation. Journal of Contemporary Finance and Economics, (4), 115-127.

Liu, Z., Li, K. W., Tang, J., Gong, B., and Huang, J. (2021). Optimal operations of a closed-loop supply chain under a dual regulation. International Journal of Production Economics, 233, 107991. https://doi.org/10.1016/j.ijpe.2020.107991

Martínez-Sola, C., García-Teruel, P. J., and Martínez-Solano, P. (2012). Trade credit policy and firm value. Accounting and Finance, 53(3), 791–808. Portico. https://doi.org/10.1111/j.1467-629x.2012.00488.x

Molina, C. A., and Preve, L. A. (2012). An Empirical Analysis of the Effect of Financial Distress on Trade Credit. Financial Management, 41(1), 187–205. Portico. https://doi.org/10.1111/j.1755-053x.2012.01182.x

Muller, D., Judd, C. M., and Yzerbyt, V. Y. (2005). When moderation is mediated and mediation is moderated. Journal of Personality and Social Psychology, 89(6), 852–863. https://doi.org/10.1037/0022-3514.89.6.852

Murfin, J., and Njoroge, K. (2014). The Implicit Costs of Trade Credit Borrowing by Large Firms. Review of Financial Studies, 28(1), 112–145. https://doi.org/10.1093/rfs/hhu051

Niskanen, J., and Niskanen, M. (2006). The Determinants of Corporate Trade Credit Policies in a Bank-dominated Financial Environment: The Case of Finnish Small Firms. European Financial Management, 12(1), 81–102. https://doi.org/10.1111/j.1354-7798.2006.00311.x

Park, S. R., Kim, S. T., and Lee, H.-H. (2022). Green Supply Chain Management Efforts of First-Tier Suppliers on Economic and Business Performances in the Electronics Industry. Sustainability, 14(3), 1836. https://doi.org/10.3390/su14031836

Patatoukas, P. N. (2011). Customer-Base Concentration: Implications for Firm Performance and Capital Markets. The Accounting Review, 87(2), 363–392. https://doi.org/10.2308/accr-10198

Peng, X., Wang, X., and Chan, K. C. (2019). Does customer concentration disclosure affect IPO pricing? Finance Research Letters, 28, 363–369. https://doi.org/10.1016/j.frl.2018.06.007

Petersen, M. A. (2008). Estimating Standard Errors in Finance Panel Data Sets: Comparing Approaches. Review of Financial Studies, 22(1), 435–480. https://doi.org/10.1093/rfs/hhn053

Petersen, M. A., and Rajan, R. G. (1997). Trade Credit: Theories and Evidence. Review of Financial Studies, 10(3), 661–691. https://doi.org/10.1093/rfs/10.3.661

Piercy, N., and Lane, N. (2006). The Underlying Vulnerabilities in Key Account Management Strategies. European Management Journal, 24(2–3), 151–162. https://doi.org/10.1016/j.emj.2006.03.005

Qiu, T. (2018). Dependence concentration and fairness perceptions in asymmetric supplier–buyer relationships. Journal of Marketing Management, 34(3–4), 395–419. https://doi.org/10.1080/0267257x.2018.1450281

Seifert, D., Seifert, R. W., and Protopappa-Sieke, M. (2013). A review of trade credit literature: Opportunities for research in operations. European Journal of Operational Research, 231(2), 245–256. https://doi.org/10.1016/j.ejor.2013.03.016

Shen, H., Xia, N., and Zhang, J. (2018). Customer-based Concentration and Firm Innovation. Asia-Pacific Journal of Financial Studies, 47(2), 248–279. Portico. https://doi.org/10.1111/ajfs.12210

Shi, X., Wang, A., and Tan, S. (2019). Trade-Credit Financing under Financial Constraints: A Relational Perspective and Evidence from Listed Companies in China. Emerging Markets Finance and Trade, 56(4), 860–893. https://doi.org/10.1080/1540496x.2018.1555462

Shi, M., and Yu, W. (2013). Supply chain management and financial performance: literature review and future directions. International Journal of Operations and Production Management, 33(10), 1283–1317. https://doi.org/10.1108/ijopm-03-2012-0112

Shin, I., and Lee, H. (2022). The effect of related party transactions on R&D investment: Evidence from Korea. Investment Management and Financial Innovations, 19(4), 99–112. https://doi.org/10.21511/imfi.19(4).2022.08

Su, C.-H. (2012). Optimal replenishment policy for an integrated inventory system with defective items and allowable shortage under trade credit. International Journal of Production Economics, 139(1), 247–256. https://doi.org/10.1016/j.ijpe.2012.05.001

Uotila, J., Maula, M., Keil, T., and Zahra, S. A. (2008). Exploration, exploitation, and financial performance: analysis of S&P 500 corporations. Strategic Management Journal, 30(2), 221–231. Portico. https://doi.org/10.1002/smj.738

Wang, Y, and Liu Z. Y. (2016). Supplier Relationships and Corporate Cash Holdings—Empirical Evidence from Listed Chinese Manufacturing Companies. Audit and Economic Research, (1), 83-91. doi: 10.3969/j.issn.1004-4833.2016.01.009

Wang, Y., and Zhu, R. X. (2017). Risk of customer concentration, government subsidies and R&D investment of firms: Evidence from listed manufacturing companies in China. Ind. Technol. Econ, 36, 76–85. doi: 10.3969/j.issn.1004-910X.2017.05.010

Wen, Z., and Ye, B. (2014). Analyses of Mediating Effects: The Development of Methods and Models. Advances in Psychological Science, 22(5), 731. https://doi.org/10.3724/sp.j.1042.2014.00731

Wen, Z. L., Zhang, L., Hou, J. T., and Liu, H. Y. (2004). Mediation effect test procedure and its application. Journal of Psychology, 36(5): 614–620.

Yan, J., Zheng, Y., Bao, J., Lu, C., et al. (2020). How to improve new product performance through customer relationship management and product development management: evidence from China. Journal of Business and Industrial Marketing, 36(1), 31–47. https://doi.org/10.1108/jbim-05-2019-0190

Fang, E. (Er), Palmatier, R. W., and Steenkamp, J. B. E. M. (2008). Effect of Service Transition Strategies on Firm Value. Journal of Marketing, 72(5), 1–14. https://doi.org/10.1509/jmkg.72.5.001

Zhang, X., Li, Q., Liu, Z., and Chang, C. T. (2021). Optimal pricing and remanufacturing mode in a closed-loop supply chain of WEEE under government fund policy. Computers and Industrial Engineering, 151, 106951. https://doi.org/10.1016/j.cie.2020.106951

Zhang, X., Zou, M., Liu, W., and Zhang, Y. (2020). Does a firm's supplier concentration affect its cash holding? Economic Modelling, 90, 527–535. https://doi.org/10.1016/j.econmod.2020.01.025

Zheng, T., Zhao, Y., and Li, J. (2019). Rising labour cost, environmental regulation and manufacturing restructuring of Chinese cities. Journal of Cleaner Production, 214, 583–592. https://doi.org/10.1016/j.jclepro.2018.12.328

Zhou, B., Li, Y., Huang, S., Guo, S., and Xue, B. (2019). Customer Concentration and Corporate Innovation: Effects of Financing Constraints and Managers' Expectation of Chinese Listed Companies. Sustainability, 11(10), 2859. https://doi.org/10.3390/su11102859