Influence of Supply Chain Geographic Proximity and Concentration on Financial Performance of Chinese Automakers

Chengbo Li[a]
School of Business, The University of Queensland, Brisbane, Australia

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Abstract: China's automobile manufacturing industry has dominated the world's automaking market for over a decade. However, given the trend of globalization and the intensified competition in the industry, supply chain network structure plays a vital role in Chinese automakers' financial performance. This paper utilized the inventory turnover ratio to evaluate the impact of supply chain concentration and geographic proximity on firms' financial performance in China's automotive manufacturing industry. To assess the impact, this research uses data of 83 firms listed on Shanghai and Shenzhen Stock Exchanges in China's automotive manufacturing industry from year of 2010 to 2023. The main findings are: first, supply chain geographic proximity is negatively related to the inventory turnover ratio; second, supply chain concentration are negatively related to the inventory turnover ratio. Therefore, both supply chain geographic proximity and concentration can negatively impact Chinese automakers' financial performance. This research provides insightful implications to firms and managers on how supply chain structure can impact financial performance.

1 INTRODUCTION

China's automobile manufacturing industry stands out due to its scale, quality, efficiency, and diversity. In 2024, China produced over 31.4 million vehicles, including 12.9 million new energy vehicles, which accounted for approximately one-third of the world total vehicle production and over two-thirds of the world's electric vehicle production (Zhang, 2025). China has maintained to be the world's largest automobile manufacturing powerhouse for 15 years since 2009, and for the first time in 2024 it surpassed Japan and Germany, becoming the world's largest automobile exporter (Chang & Bradsher, 2024). However, given the dominant position of China's automobile manufacturing industry in the world, it also faces tremendous internal and external challenges and uncertainties, such as geopolitical risks, environmental impacts, digital transformation, industrial upgrading, and natural disasters. To tackle these challenges and remain a sustainable and competitive advantage in the global market, it is vital to evaluate the impact of Chinese automakers' supply chain network structure on their financial performance. Many studies have been conducted to demonstrate supply chain factors that can influence the financial performance of China's automobile manufacturing industry, including visibility, digitalization, network complexity, inventory management, and communication. However, as critical structural components of supply chain network, the influence of geographic proximity and concentration on the financial performance of Chinese automakers remain under-investigated. Inventory turnover ratio is a perfect metric to measure both the supply chain and financial performance of firms. It not only evaluates how quickly a firm can sell its inventory in a given period, which is closely related to a firm's supply chain management capacity, but also is commonly referred to as a common metric to measure sales efficiency, which reflects a firm's financial performance (Kwak, 2019). Thus, the objective of this research is to explore and evaluate the correlation among supply chain proximity, concentration, and business performance based on a firm's inventory turnover ratio within China's automobile manufacturing industry. Particularly, this paper seeks to answer two questions: First, does supply chain proximity significantly impact China's automobile manufacturing firms' financial

[a] https://orcid.org/0009-0000-5566-5518

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performance? Second, does supply chain concentration significantly impact businesses' financial performance within China's automobile manufacturing industry?

2 LITERATURE REVIEW

2.1 Impact of Supply Chain Concentration on Financial Performance

Supply chain concentration measures a company's dependence on a small group of up and downstream critical business partners. Thus, high supply chain concentration indicates that an organization is highly dependent on its suppliers and customers on raw materials and sales channels. Scholars have conducted various academic research on supply chain concentration and its impact on business financial performance. It is evident that supply chain concentration is capable of influencing supply chain resilience as it reflects a firm's dependence on its major trading partners (Jiang et al., 2023). Supplier concentration generally represents the degree of a firm's raw material or service dependence on its major suppliers. Therefore, high supplier concentration, meaning a firm's physical and informational resources are predominantly obtained from a few upstream suppliers, would hinder a firm's inventory, production, and operation when risks occur to its suppliers. However, low supplier concentration usually means a low level of collaboration between the firm and suppliers, which would increase the firm's supply chain network the complexity and potentially magnify the bullwhip effect within its supply chain. Similarly, customer concentration usually indicates the portion of a firm's sales revenue generated from a small group of large customers (Chen & Xu, 2024; Jiang et al., 2023). Hence, high customer concentration indicates that a firm's product sales are primarily reliant on a few selected customers, which would become an operational obstacle when disruption happens to downstream major customers. Whereas, low customer concentration usually indicates poor customer collaboration and relationship management. Additionally, according to Porter's (2008) theory, firms lose tremendous bargaining power and competitive advantages when their operations rely too much on a small group of suppliers or customers. Therefore, supplier and customer concentration can significantly influence a firm's supply chain resilience, which in turn affects its overall financial performance.

2.2 Impact of Supply Chain Geographic Proximity on Financial Performance

Supply chain geographic proximity is also referred to as the spatial distance between a firm and its suppliers or customers (Cortes, 2023). It was largely considered a major role that affects communication efficiency between organizations. For instance, previous studies show that companies within a proximity tend to have a better communication channel to share information, thereby promoting collaborations and improving visibility (Yang & Ren, 2021). However, given the modern technology development, especially the development of the internet, communication between organizations is no longer considered a major factor that affects firms' selection of supply chain partners on the basis of geographic location. Despite the communication efficiency between firms no longer relies entirely on the distance, other factors that associated with geographic proximity remain playing critical roles influencing firms' decision on suppliers and customers selection as supply chain complexity increases. For example, supplier selection is generally based on consideration of cost, efficiency, time, product quality, and variety. Therefore, companies within a proximity would benefit from lower transportation costs, shorter lead time, and more agile inventory policies, which in turn enhance the overall supply chain resilience (Lorentz et al., 2012). Furthermore, a resilient supply chain could reduce overall operating costs, hence, improve firm's overall financial performance.

2.3 China's Auto Manufacturing Industry Supply Chain Characteristics

Despite the current dominant position of China's automobile manufacturing industry in the global market, the industry is currently facing many complex supply chain problems due to its rapid development history and the current fast-paced transition to new energy vehicles. Over recent decades, China's automaking sector has evolved from a highly decentralized structure to industrial clusters where manufactures and suppliers operate within the same geographic regions (Cao et al., 2022; Y. Huang et al., 2020; Sun & Abdullah, 2025). This clustering structure offers automakers with significant advantages, including low transportation costs and

low production delay risks. Thus, firms naturally prefer to trade with businesses with who they have already established a good relationship and within close geographic proximity (Cao et al., 2022). However, supply chain tension occurred with the growing expansion of the industry. Especially when there are hundreds of automakers and thousands of component manufactures, not to mention the fact that these numbers are still growing rapidly (Y. Huang et al., 2020). The increasingly crowded supply chain would intensify not only the competition across the entire industry, but also the corporate decision-making process regarding trading partner selection and management, which in turn exacerbate the supply chain complexity of the industry (Z. Huang et al., 2024; Sun & Abdullah, 2025). Moreover, the trend of new energy vehicle transition introduces additional layers of supply chain complexity. Conventional automakers and their suppliers have to both collaborate with and compete against newly formed new energy vehicle manufacturers and their specialized suppliers due to differences in manufacturing technology, supplier specification, and customer segmentation (Cao et al., 2022). On one hand, conventional automakers must cooperate with and learn from new energy vehicle firms to achieve their industrial upgrading and transition objectives; on the other hand, conventional automakers face intensifying competition from the same new energy vehicle manufacturers for critical suppliers and customers. Additionally, some industry clusters centered by new energy vehicle manufacturers established in regions that are geographically distant from conventional automakers, creating spatial fragmentation in China's automotive supply chain network which resulting in new challenges in logistics coordination and supply chain integration (Cao et al., 2022). Consequently, this makes the supply chain of the whole industry even more complex. Therefore, it is significant to investigate the impact of supply chain distance and concentration on automakers' financial performance.

3 METHODOLOGY

3.1 Data Collection and Processing

All data was extracted from the CSMAR (China Stock Market and Accounting Research) database, which is an intensive, definitive, and reliable research-oriented platform in line with global professional standards highlighting China's finance and economy while incorporating China's exclusive national characteristics. Therefore, data from 83 firms listed on Shanghai and Shenzhen Stock Exchanges in China's automotive manufacturing industry as samples provides a solid foundation supporting this research to answer the above research questions. The earliest available data of both supply chain geographic distance index and supply chain concentration index of China's automobile manufacturing industry can be tracked from 2001, whereas firms' financial information only started to be disclosed from 2010. Therefore, key metrics in each dataset, including end date, stock symbol, and industry classification code, were used to consolidate all necessary and meaningful data into one unified dataset. Consequently, all the data of Chinese automakers used in this research were based on the combination of the above datasets, from year of 2010 to 2023.

3.2 Variable Measurements

Types, abbreviations, and descriptive statistics of variables are presented in Table 1 and Table 2.

Table 1: List of variables, abbreviations, and data sources

Type	Variable	Abbreviation	Data Source
Dependent Variable	Inventory turnover ratio	ITR	CSMAR
Independent Variables	Spatial distance	SD	CSMAR
	Major customer ratio	MCR	CSMAR
	Major supplier ratio	MSR	CSMAR
	Customer concentration	CC	CSMAR
	Supplier concentration	SC	CSMAR
Control Variables	Close proximity	CP	CSMAR
	Same province	SP	CSMAR

3.2.1 Dependent Variable

To evaluate the impact of supply chain metrics on financial performance, the inventory turnover ratio was selected as the dependent variable. It measures a firm's efficiency in selling out its inventory in a given period, which in turn reflects not only a firm's overall supply chain management capacity but also shows its financial performance. A high inventory turnover ratio is always favorable to firms since it demonstrates their high financial liquidity level and supply chain efficiency level.

3.2.2 Independent Variable

As shown in the Table 1, independent variables used in this research were spatial distance, major customer ratio, major supplier ratio, customer concentration, and supplier concentration.

Spatial distance was selected to assess the geographic distance between a firm and its supplier or customer, which helps to evaluate the impact of supply chain proximity on financial performance.

Major customer ratio was calculated by dividing a firm's revenue from its single largest customer by its yearly total sales. This metric quantifies the dependence level of the firm to the largest customers.

Major supplier ratio was derived by dividing a firm's annual procurement from the single largest supplier by the firm's yearly total purchasing volume. This variable assesses the dependence level of a firm on the largest supplier.

Customer concentration was calculated by dividing the revenue generated from the top five major customers by a firm's yearly total sales. This variable reflects a firm's sales channel dependence on key customers.

Supplier concentration was derived by dividing a firm's annual purchases from its top five suppliers by its total annual purchases. This variable measures a firm's source of goods dependence on major suppliers.

3.2.3 Control Variable

Close proximity dummy variable was constructed as a control variable. It is assigned 1 if the distance between a firm and its supply chain partner (supplier or customer) is less than 300 km, and 0 otherwise.

Same province dummy variable was included as a control variable to show whether a supply chain partner (supplier or customer) is located in the same province as the firm. It is 1 if they are in the same province, and 0 otherwise.

Table 2: Descriptive statistics

Variables	Obs.	Mean	S.D.	Min.	Max.
Inventory Turnover Ratio	452	5.490	3.838	1.480	39.955
Spatial Distance	452	559.432	583.062	0.706	2418.294
Major Customer Ratio	452	22.930%	15.196%	0.890%	78.210%
Major Supplier Ratio	452	14.621%	13.407%	1.780%	63.300%
Customer Concentration	452	47.376%	23.013%	4.110%	99.300%
Supplier Concentration	452	31.867%	17.777%	6.740%	89.380%

3.3 Analysis

The regression model can be specified as follow:

$$ITR = \beta_0 + \beta_1 SD + \beta_2 MCR + \beta_3 MSR + \beta_4 CC + \beta \quad (1)$$

Where *ITR* is the dependent variable inventory turnover ratio; *SD* is the spatial distance between firms and suppliers or customers; *MCR* represents the major customer ratio; *MSR* represents the major supplier ratio; *CC* is the customer concentration; *SC* is the supplier concentration; *SP* and *CP* denote control variables same province indicator and proximity indicator, respectively.

4 RESULTS

This section shows the results of this analysis with interpretations. The variance inflation factor (VIF) was employed in all regression analyses to detect potential multicollinearity problems. As a result, multicollinearity is not an issue in this analysis since all regressions displayed a VIF coefficient lower than 5.

Table 3: Regression results.

Variables	Dependent Variable: Inventory Turnover Ratio		
	(1)	(2)	(3)
Intercept	8.796*** (15.487)	7.697*** (17.980)	7.275*** (17.275)
Spatial Distance	-0.001** (-0.096)	-0.001*** (-4.532)	-0.001*** (-4.051)
Major Customer Ratio	0.062*** (3.922)	---	---
Major Supplier Ratio	0.032 (1.524)	---	---
Customer Concentration	-0.063*** (-6.086)	---	-0.023*** (-2.987)
Supplier Concentration	-0.062*** (-3.937)	-0.045*** (-4.288)	---
Same Province	1.107*** (2.589)	---	---
Close Proximity	-0.818 (-1.553)	---	---
N	452	452	452
R2	0.229	0.081	0.061
F	16.237	18.014	14.496

Note: *, **, and *** represents the significance at 10%, 5%, and 1% level, respectively. Values in parentheses are t-statistics.

4.1 Impact of Supply Chain Geographic Proximity on Inventory Turnover Ratio

Table 3 shows the regression analysis results of the impact of supply chain geographic proximity on the inventory turnover ratio of China's automakers. Column 1 shows the overall impact of supply chain geographic distance on a firm's inventory turnover ratio. The results indicate that the distance between firms and their up and downstream trading partners is negatively and significantly related to firms' inventory turnover ratio ($B = -0.001$, $p < 0.05$). The -0.001 coefficient denotes that each kilometer increase in distance between a firm and its supply chain partners, the firm's inventory turnover ratio drops 0.001 times per year. For instance, if the distance between a firm and its supplier increased 1000 kilometers, then based on the results, the firm's inventory turnover ratio would decrease for 1 time per year. Moreover, firms and their trading partners located within the same province can positively and significantly impact firms' inventory turnover ratio ($B = 1.107$, $p < 0.01$). The coefficient of the Same Province dummy suggests that a firm's inventory turnover ratio would increase 1.107 times per year when intra-province collaboration occurred. Furthermore, the individual impact of supplier distance and customer distance on inventory turnover ratio are shown in column 2 and 3, respectively. The results confirm that supplier distance is negatively and significantly related to a firm's inventory turnover ratio ($B = -0.001$, $p < 0.01$), and customer distance is negatively and significantly related to a firm's inventory turnover ratio ($B = -0.001$, $p < 0.01$). Additionally, the R^2 value of the regression model is 0.229, signifying that 22.9% of the variance in the dependent variable can be explained by the independent variables. This R^2 value is statistically acceptable as the purpose of this research was to explore the causal relationship instead of the predictive modeling.

4.2 Impact of Supply Chain Concentration on Inventory Turnover Ratio

The regression results of the impact of supply chain concentration on Chinese automakers' inventory turnover ratio are shown in Table 3. The overall impact of supply chain concentration on businesses' inventory turnover ratio can be found in column 1. The results indicate that both up and downstream trading partner concentration are negatively and significantly related to firms' inventory turnover ratio, with a B value of -0.063 ($p < 0.01$) and -0.062 ($p < 0.01$), respectively. The coefficient of customer concentration denotes that for every 1% increase in the customer concentration the inventory turnover ratio would decline 0.063 times per year. For example,

if a firm's customer concentration increased 20%, its inventory turnover ratio will decrease 1.26 times per year. Similarly, the coefficient of supplier concentration indicates that for every 1% higher in the supplier concentration, the inventory turnover ratio drops 0.062 times per year. Thus, a 20% growth in supplier concentration would result in a 1.24 times per year reduction in inventory turnover ratio. Moreover, the individual impact of supplier or customer concentration on inventory turnover ratio is shown in column 2 or 3, respectively. The results indicate that supplier concentration is negatively and significantly related to inventory turnover ratio ($B = -0.045$, $p < 0.01$), and customer concentration is also negatively and significantly related to inventory turnover ratio ($B = -0.023$, $p < 0.01$). Overall, the above statistic results offer a basic answer to the second research question.

5 CONCLUSIONS

This research evaluates the impact of supply chain geographic proximity and concentration on the financial performance of China's automobile manufacturing firms. This study utilized data from 83 firms listed on Shanghai and Shenzhen Stock Exchanges in China's automotive manufacturing industry from 2010 to 2023.

First, the empirical results confirmed that the geographic distance between automakers and their supply trading partners can negatively impact their inventory turnover ratio. Specifically, each kilometer increased in supplier or customer distance reduced inventory turnover ratio by 0.001 times per year. Moreover, the inventory turnover ratio increased significantly when intra-province collaboration occurred. This indicates that the impact of geographic proximity on inventory turnover is not a simple linear relationship, but rather demonstrates a threshold effect: negative impacts intensify when distance exceeds a certain range, whereas closer proximity within same province displays significant positive effects. The primary drivers behind this phenomenon includes transportation cost, transit duration, and manufacturing lead times. These factors not only hinder firms' financial performance due to cost escalations, but also result in unexpected production schedule disruptions due to extra logistics cycles. Therefore, to address geographic proximity challenges, managers should prioritize intra-province collaboration to reduce transit time and costs. For instance, firms could invest in industrial parks to utilize the proximity benefits.

Second, the empirical findings revealed a negative correlation between supply chain concentration and the inventory turnover ratio. Specifically, an increase in supply chain concentration reduces the inventory turnover ratio. Moreover, it is noteworthy that a firm's dependence on the largest customer is negatively related to its inventory turnover ratio, whereas its financial dependence on its largest supplier did not show a significant relation to its inventory turnover ratio. For firms with high supply chain concentration, their upstream sources of materials and downstream sales channels are highly dependent on their major trading partners. Consequently, firms would have minimal bargaining power regarding price, quantity, and variety of goods they purchase and products they sell. This substantially impacts firms' financial independence, profitability, supply chain effectiveness, and product diversity, which in turn reduces firms' inventory turnover ratio, supply chain resilience, and supply chain agility. Therefore, firms should reduce reliance on major trading partners, especially the single large customer, and build alternative supply chain networks for sources of materials and streams of revenue to avoid a financial bottleneck.

This research is subject to limitations. First, the data used in this research were extracted and combined from multiple datasets based on the date, stock symbol, and industry classification code. Thus, given the availability of the primary metrics differs in these datasets, not only was the data size significantly reduced, but also much additional useful information from these datasets was excluded during the data integration phase. Hence, future research could utilize multiple sources of information to enhance data availability when acquiring research data. Second, this research only focused on the impact of two supply chain parameters on one business financial indicator. Future research could combine other statistical measures, including firm size, location, and other financial ratios, to comprehensively understand the impact of supply chain proximity and concentration on financial performance.

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