

# Research on the Moderating Role of Internal Controls in Supply Chain Management and Business Performance--An Empirical Analysis Based on the Data of Listed Companies of A-share Food Enterprises

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**Abstract.** The era of digital economy brings unprecedented challenges and opportunities to food companies. In order to cope with the challenges and rapidly increase competitiveness, enterprises should focus on supply chain management from the concept of overall process, and how food enterprises can strengthen supply chain integration and increase competitiveness has become a hot spot of scholars' research. We therefore divide supply chain management into two dimensions: supplier integration and customer integration, and introduce internal control as a moderating variable to construct a theoretical model related to the impact of supply chain management on operational performance of food enterprises. The relationship between supply chain management and corporate performance is then examined by selecting A-share listed companies in the food industry from 2012 to 2021 as samples for the multiple linear regression model. The model is validated by using the data analysis software stata and observing the results of the multiple linear regression. The results show that both supplier integration and customer integration are successful in enhancing firm performance, while internal control moderates the impact of supplier integration and customer integration on firm performance.

**Keywords:** Internal control; Supply Chain Integration; Multiple linear regression; Empirical analysis.

## 1 Introduction

The digital economy has made the market more globalized and competitive, and in this context, food companies are facing a complex external environment, including changes in market demand, intensified competition, and modifications in laws and regulations brought about by the digital economy, which have made supply chain management more complex for food companies. In addition to the challenges the digital economy also brings certain opportunities for food enterprises, supply chain management is developing rapidly in the context of the digital economy, the digital economy helps to establish closer customer relationships and improve customer loyalty, but also provides companies with new ways to interact with customers. Supply chain management enables businesses to better compete, ensure product quality, and satisfy customers by addressing challenges and seizing opportunities. Consolidating suppliers helps food companies achieve economies of scale in the production chain, which has an impact on performance. Consolidating customers has benefits in the sales chain as well. In the digital

economy, meeting customer demand alone can make a business unbeatable, whereas customer integration lowers the costs businesses incur in meeting customer demand and influences performance.

Food businesses must strengthen supply chain integration while also enhancing the flexibility and agility of their supply chains in order to meet the challenges posed by the data economy and to take advantage of opportunities. An essential component of supply chain management, internal control management, is crucial to its success. In addition to lowering risks, making resources more efficient, and ensuring compliance, it also strengthens information reliability, ensures business continuity, and safeguards the stability of supplier relationships, all of which contribute to the long-term sustainability of businesses. It can be seen that internal control can influence the intensity and form of supply chain integration, and thus effect the relationship of supply chain integration on business performance. In supply chain management, food enterprises should pay attention to the construction of internal control to ensure the efficient, stable and sustainable development of the supply chain. Effective internal control helps to reduce internal and external risks, including financial risk, compliance risk and operational risk, improve the effective use of resources, reduce waste and loss, and then affect performance.

As can be seen, customer integration helps establish a stable customer base, improve sales stability, and lessen the impact of market fluctuations. Internal control can ensure product quality and safety and reduce compliance risk. Supplier integration helps ensure the quality and availability of raw materials, reduce costs, improve productivity, and thus increase competitiveness. To increase competitiveness and maintain development, all three are crucial for food firms.

Therefore, this study uses empirical analysis to investigate the relationship between supply chain integration, internal control and corporate performance, and then uses the big data analysis tool stata17 to perform multiple linear regression on the relevant data, and provides recommendations for food companies based on the results of the study.

## **2 Literature review and hypotheses development**

### **2.1 Supply Chain Integration and Business Performance**

External integration is the management of suppliers and customers to improve inter-organizational cooperation; internal integration is the improvement of cooperation and communication between enterprise departments, the optimization of the enterprise's management process, and the management measures of the trading partners, and is an effective complement to external integration of the supply chain<sup>[1]</sup>. The dimensions of supplier integration and customer integration are where most academics study supply chain integration.

Effective supplier consolidation helps businesses find opportunities to cut costs in the supply chain and boosts supplier performance through improved chain-wide cooperation and coordination. The tight cooperation and resource sharing with important suppliers made possible by supplier consolidation helps produce high-quality goods and services. Supplier integration can also enhance the flow of information throughout the supply chain, improve collaboration, and save costs. According to some scholars, supplier consolidation that is more extensive than the average degree of integration has a substantial impact on business performance and

particularly aids in raising the level of performance of the company<sup>[2]</sup>. In order to lower transaction costs, reduce information asymmetry, and increase supply chain efficiency and synergies, firms can also combine and manage upstream and downstream resources through supplier consolidation<sup>[3]</sup>. This raises the company's performance level. In addition to addressing problems with operational costs and product quality, supplier consolidation has the potential to boost productivity, competitiveness, and operational effectiveness. Based on this the hypothesis is proposed: H1: Supplier consolidation can contribute to improved business performance.

Reduced information asymmetry between consumers and businesses, improved customer trust, and improved business performance are all benefits of good customer integration in the supply chain as a "means" of creating firm value. Customer integration greatly increases inventory efficiency and valuation premium, which in turn improves the profitability of the business. Strong relationships with customers also encourage information sharing and cooperation between the two sides<sup>[4]</sup>. company profitability rises dramatically as key customer relationships mature, and customer integration is favorably correlated with company performance<sup>[5]</sup>. As a result, when a company has developed strong bonds with a select group of important clients, it can rely on more consistent orders and sources of income, which enhances the performance of the business. The hypothesis is proposed: H2: Customer integration can promote the improvement of business performance.

## **2.2 Moderating effect of the quality of internal controls**

Internal control refers to the many safeguards implemented by an organization to meet its goals, control risks sensibly and effectively, and optimize resource allocation. When there are problems with the corporate governance structure, internal controls can be used to solve the problems by using management controls to make corporate governance more compliant. One of the crucial systems in a business, internal control can improve internal governance of the Division capable within a division and raise management levels<sup>[6]</sup>.

When companies implement good quality of internal control, it can reduce the rate of product defects to improve efficiency, and can improve the problems in the production process, reduce the recovery cost of the company, and then improve the financial and market performance of the company<sup>[7]</sup>. The quality of internal control can make the development of coordination and stability between the internal organizations of the enterprise, improve the operational efficiency of food enterprises, reduce the cost of product output, promote the performance of food enterprises, and compared with other companies, if the company has a better internal control system, it will have a significant positive impact on its performance improvement<sup>[8]</sup>. Based on this hypothesis H3: the quality of internal control can promote the improvement of corporate performance.

Organizations can reduce risks connected with suppliers, such as compliance risk, price risk, and delivery risk, by using internal controls. To preserve the stability and continuity of supply chain collaboration, internal controls can be used to screen out suppliers with inconsistent qualifications before a company collaborates with them and clearly define the principles and procedures of ownership and management of the collaboration process. By delivering superior internal control signals to draw superior trade partners at the conclusion of the partnership, it can also raise supplier quality. The impact of risks on performance can be reduced when more hazards emerge, and risks can be handled. Based on this, the hypothesis is proposed: H4:

Internal control plays a positive moderating role in the relationship between supplier integration and business performance.

Internal controls can be used to handle several facets of the sales process, contract management, risk assessment, and management, allowing businesses to better manage their relationships with their most important clients. Effective internal controls can demonstrate a company's creditworthiness and draw in upstream and downstream businesses as possible trading partners. Internal control can raise the degree of internal integration in the company's upstream and downstream chains when customer integration remains stable. Standardized management processes can save transaction costs, transfer customer risks to monitor and prevent bad effects, and improve advantages to the business when customer concentration is more inclined to demand management and satisfaction. Based on this, hypothesis H5 is proposed: internal control plays a positive moderating role in the relationship between customer integration and business performance.

The theoretical model diagram is shown in Fig 1

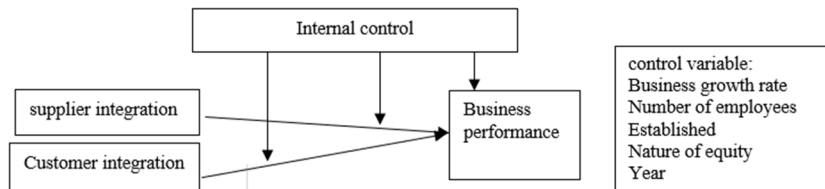


Fig 1. Diagram of the theoretical model.

### 3 Research design

#### 3.1 Description of variables

The impact of supply chain integration and internal control on corporate performance can be explored in greater detail in A-share food companies because they are better able to represent the Chinese market and have a higher level of supply chain integration. This allows for the development of targeted management recommendations for the sector. As a result, the research object for this study is A-share listed food companies. Data from 2012 to 2021 can offer more complete and accurate information. Additionally, this time frame includes significant occurrences related to the supply chain integration and corporate competition of food companies, including the incidents involving tainted milk powder and lean meat extract. As a result, information from 2012 to 2021 is gathered. According to the research needs of this paper, ROE is chosen as the explanatory variable in the model; the ratio of the top five suppliers' annual purchase amount to the total annual purchase amount and the top five customers' annual sales amount to the total annual sales amount are used to indicate the supplier integration and customer integration, respectively; the DIB index indicates the internal control; and business growth rate, number of employees, Established, time and nature of equity were selected as control variables.

In order to assure the correctness of the results and prevent an excessive gap between the data, the internal control index and the number of employees are collected as logarithmic numbers. Elimination and screening , a total of 748 valid data are acquired. All the empirical tests were carried out with stata17 software.

### 3.2 Model building

In order to verify the relationship between supply chain integration and performance, model (1) (2) is constructed; in order to verify the relationship between internal control and performance model (3) is constructed and its moderating role is modeled as (4) (5)

$$ROE = \beta_0 + \beta_1 \text{Supply} + \Sigma \text{Controls} + \text{Year} + \xi_1 \quad (1)$$

$$ROE = \beta_2 + \beta_3 \text{Customer} + \Sigma \text{Controls} + \text{Year} + \xi_2 \quad (2)$$

$$ROE = \beta_4 + \beta_5 \text{IC} + \Sigma \text{Controls} + \text{Year} + \xi_3 \quad (3)$$

$$ROE = \gamma_1 + \gamma_2 \text{Su} + \gamma_3 \text{Supply} * \text{IC} + \gamma_4 \text{IC} + \Sigma \text{Controls} + \text{Year} + \xi_4 \quad (4)$$

$$ROE = \gamma_5 + \gamma_6 \text{Customer} + \gamma_7 \text{Customer} * \text{IC} + \gamma_8 \text{IC} + \Sigma \text{Controls} + \text{Year} + \xi_5 \quad (5)$$

Where Supply denotes supplier concentration; Customer denotes customer concentration; IC denotes internal control index; Controls is the corresponding control variable; Supply\*IC is the interaction term between internal control and supplier concentration; Customer\*IC is the interaction term between internal control and customer concentration, and in the regression results the interaction term is denoted by Ini; Year is the year variable.

## 4 Research analysis and results

### 4.1 Descriptive statistics

Table 1 shows the results of descriptive statistics using the data analysis software stata17. The sample size is 748, and descriptive statistics show that the average level of supplier integration is slightly higher than customer integration, indicating that supplier integration is more highly valued.

**Table 1.** Descriptive statistics of variables.

Name	N	Mean	MIN	MAX	SD
ROE	748	44.6	3	74	9.2
Supply	748	27.0	4.16	67	14.5
Customer	748	16.4	1.67	78	14.1
IC	748	5.6	0	6.75	1.4
Business growth rate	748	52.7	1	122	26.3
Number of employees	748	8.09	5.74	11.03	1.2
Established	748	1998	1987	2011	4.5
Nature of equity	748	0.39	0	1	0.49

## 4.2 Correlation test

Table 2 shows the results of the correlation test for the main variables using the data analysis tool stata17 .Through Table 2, The relationship between internal control and business performance is initially validated by the correlation test, which reveals a straightforward positive correlation between internal control and business performance. Furthermore, further research is required because there is no clear-cut relationship between supply chain integration and business performance.

**Table 2.** Correlation of main variables.

	ROE	Supply	Customer	IC	Business growth rate	Number of employees	Established	Nature of equity
ROE	1							
Supply	-0.006	1						
Customer	-0.04	0.329***	1					
IC	0.247** *	-0.038	-0.041	1				
Business growth rate	0.276** *	0.020	0.052	0.211 ***	1			
Number of employees	0.391** *	-0.421***	-0.360***	0.229 ***	0.027	1		
Established	0.113** *	-0.125***	-0.098***	0.025	0.093 **	0.089 **	1	
Nature of equity	0.076**	0.054	0.129***	0.091 **	-0.053	0.088 **	- 0.258 ***	1

## 4.3 Regression analysis

Table 3 shows the results of multiple linear regressions of the model using the data analysis tool. Table 3 (1) presents the regression findings between supplier integration and business performance. It can be seen that the standardized coefficient of supplier integration and business performance is 0.12 ( $P < 0.01$ ), indicating that supplier integration has a significantly positive impact on business performance. The results of the regression between customer integration and business performance are shown in Table 3(2). The relationship between customer integration and business performance has a standardized coefficient of 0.006 ( $P < 0.01$ ), which shows that it significantly improves business performance. favorably affects the effectiveness of businesses.

Table 3(3) displays the findings of the regression between internal control and operational performance. Internal control management significantly improves business performance, as shown by the standardized coefficient between internal control management and business performance, which is 0.619 ( $P < 0.01$ ).

The regression results of the internal control management's moderating role in the association between supplier integration and operational performance are displayed in row (4). Internal control has a positive moderating role in the relationship between supplier integration and operational performance, as shown by the regression coefficient of the interaction term between

internal control and supplier integration, which is 0.046 ( $P < 0.01$ ) in Table 3. The results of the moderating role of internal control management in the relationship between customer integration and operational performance are shown in (5) in Table 3. Internal control has a positive moderating role in the relationship between customer integration and operational performance, according to the regression coefficient of the interaction term of internal control and customer integration, which is 0.085 ( $p < 0.01$ ) and significant.

**Table 3.** Multiple linear regression results.

Name	1 ROE	2 ROE	3 ROE	4 ROE	5 ROE
Supply	0.12*** (5.82)			0.106*** (5.16)	
Customer		0.006*** (2.63)			0.034** (1.8)
InIC			0.619*** (2.94)	0.633** (2.96)	0.746*** (4.04)
Interaction Term				0.046*** (3.58)	0.085*** (6.83)
Business growth rate	0.089*** (7.27)	0.09*** (7.21)	0.085*** (6.72)	0.082*** (6.61)	0.084*** (6.72)
Number of employees Established	3.597*** (13.95)	3.227*** (12.4)	2.79*** (11.35)	3.478*** (13.39)	3.194*** (12.38)
Nature of equity	0.19*** (2.94)	0.167*** (2.59)	0.158** (2.47)	0.181** (2.80)	0.164** (2.59)
Year	1.305** (2.12)	1.291** (2.11)	1.393** (2.19)	1.145* (1.86)	1.035* (1.7)
R <sup>2</sup>	0.28	0.26	0.26	0.29	0.29

## 5 Conclusion

This paper carries out a relevant research on supply chain integration and business performance of food enterprises, and adds internal control quality as a moderating variable, Using big data analysis tool stata17 softwar to empirical analysis and constructing multiple linear regression models to test the relationship between supply chain integration and business performance under the regulation of internal control quality, and finds that the integration of customers, the integration of suppliers, and the quality of internal control of food enterprises have a significant positive impact on business performance, and the quality of internal control plays a positive moderating role in it.

As a result, businesses should focus on supply chain relationship management and customer relationship management to optimize their supply chain management strategy. Actively manage external resources, enhance upstream and downstream supply chain partners, and enhance supplier integration. According to the characteristics of the industry, appropriate supplier relationships should be established, and attention should also be paid to the individual needs of customers to establish new types of cooperative relationships with customers and enrich customer management. In addition to supplier and customer relationships, internal resource

management should also be emphasized, internal control management should be strengthened, and an internal control system in line with the development of the supply chain should be designed to give full play to the strengths of the supply chain body, thus promoting the growth of operational performance.

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