

# *Asymmetric Impact of Supply Chain Stability on New Quality Productivity: A Perspective Based on Financing Constraints and Concentration*

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**Abstract.** This study selects sample data of China's A-share listed companies from 2011 to 2023 to analyze the relationship and mechanism between supply chain stability and the development level of new quality productivity. The results show that supply chain stability is positively correlated with new quality productivity, that is, a stable supply chain contributes to the cultivation of new quality productivity. Heterogeneity analysis indicates that this positive impact is more significant in enterprises with high supply chain concentration and high financing constraints. This study enriches the research on the influencing factors of new quality productivity and the economic consequences of supply chain stability, and has certain practical reference significance.

**Keywords:** Supply Chain Stability, New Quality Productivity, Trade Credit Financing, Supply Chain Concentration

## 1. Introduction

New quality productivity is a brand-new production factor that meets the practical development needs of the new era, with the core characteristics of technology intensity, outstanding efficiency and excellent quality. To cultivate and steadily expand new quality productivity, it is necessary to rely on a complete system support built by scientific and technological innovation breakthroughs, industrial structure optimization and upgrading, and the coordinated operation of the macroeconomic system. At present, domestic academic research on this topic is mostly limited to conceptual interpretation and theoretical deduction of macro-driven mechanisms, and few studies use empirical data to analyze the actual impact of supply chain stability on the development of new quality productivity. Based on this obvious research gap, this paper conducts empirical tests based on quantitative methods and finally draws a series of reliable conclusions. Maintaining stable supply chain operation will significantly boost the growth of enterprises' new quality productivity. This conclusion has been fully verified through multi-dimensional robustness tests. Among enterprises with high supply chain concentration and tight overall financing environment, this positive promotion effect is more significant.

Firstly, this study effectively expands the research scope of the influencing factors of new quality productivity. Most existing literature analyzes from the micro perspective of enterprises, while this

study extends the research perspective to the cross-enterprise collaboration mechanism, focuses on in-depth discussion of supply chain stability, and systematically sorts out the internal path of its role in the cultivation and formation of new quality productivity, which can provide a theoretical basis with more practical reference value for subsequent policy formulation and industry practice. Secondly, it continuously enriches the research connotation of the driving effect of supply chain stability. Previous academic discussions on supply chain stability basically focused on the single field of operational risk prevention and control. This paper breaks the traditional research boundary, incorporates supply chain stability into the comprehensive evaluation framework of enterprise technological innovation capability for the first time, and clearly shows that a stable supply chain system plays an irreplaceable supporting role in the whole process of enterprise technological innovation and commercialization of innovative achievements [1]. Thirdly, it can promote the two-way collaboration between government and enterprises and help the effective implementation of the goal of precise industrial governance. Combined with the core characteristics of supply chain stability that can strengthen R&D continuity and improve technology diffusion efficiency, the analysis results of this study can not only provide empirical reference for enterprises to rationally allocate various resources and improve internal resource allocation models, but also lay a solid theoretical foundation for government departments to plan industrial development directions and build an efficient industrial support system [2].

## 2. Literature review

### 2.1. Literature on new quality productivity

This study selects new quality productivity as the core research object. Through systematic sorting and comprehensive analysis of existing literature, it is found that current academic research on this topic can be summarized into two main lines: one is the in-depth discussion of the connotation and characteristics of new quality productivity; the other is the analysis of its operating mechanism and driving forces. In terms of connotation definition, scholars generally agree on the key significance of the three elements of new technology, high quality and production efficiency improvement, and focus on the interactive relationship between technological innovation capability, resource factor collaboration efficiency and its adaptability to regional economic strategies [3]. Research on influencing factors shows that external conditions such as human capital accumulation, policy support, market mechanism improvement and capital allocation scale all play an important role in promoting the development of this field [4-6].

### 2.2. Literature on supply chain stability

Academic research on supply chain stability mainly focuses on two levels: on the one hand, focusing on its promoting effect on enterprises' internal operational performance; on the other hand, deeply exploring its transmission mechanism and spillover impact in the capital market [7, 8].

At present, most academic studies on supply chain stability focus on the two core directions of enterprise actual operation management and capital market performance. From the perspective of micro enterprises, a stable and reliable supply chain system can effectively weaken various uncertain risks in enterprise operation. It can not only lay a solid foundation for enterprise financing decisions, but also help enterprises continuously cultivate technological innovation strength in the long-term development process and steadily improve their comprehensive market competitive advantages [9]. From the overall dimension of macroeconomy and finance, an efficiently operating supply chain

model can effectively optimize the information transmission efficiency between suppliers and demanders, and greatly improve the widespread information asymmetry under the environment of market fluctuations. It allows enterprises to maintain long-term operation with lower risk premium and financing costs and continuously achieve high-quality development. The subsequent positive spillover effect will also deeply affect the price fluctuation trend of the overall market and simultaneously improve the systemic risk prevention and control capacity of the whole industry [10, 11].

### 3. Research hypotheses

Based on existing literature, it is found that the impact of supply chain stability on new quality productivity is mainly realized through three core mechanisms: resource guarantee, innovation incentive and structure optimization [12]. On the one hand, a stable and efficient supply chain provides a reliable guarantee for the supply of key production factors, helps reduce operational risks and cost expenditures, and then promotes the improvement of green total factor productivity; on the other hand, it significantly reduces the negative impact of external environmental uncertainty on enterprises, inhibits short-termism, strengthens R&D investment intensity, improves the frequency of technological breakthroughs and their adaptability to the ecological environment, and lays a solid foundation for sustainable development [13, 14]. By eliminating cooperation barriers and building a long-term collaboration mechanism, supply chain stability promotes knowledge-driven technological change, improves the industrial chain and resource allocation pattern, guides the industrial structure to transform to high value-added, intelligent and high-tech fields, enhances the ability to resist market fluctuations, and thus comprehensively assists the development process of new quality productivity [15].

Based on the above views, this paper innovatively puts forward the core research hypothesis:

H1: High stability of the supply chain can promote the improvement of new quality productivity.

## 4. Research design

### 4.1. Sample selection and data sources

Based on the established theoretical framework and data collection methods, this study selects A-share listed enterprises from 2011 to 2023 as the research objects. Supply chain-related data are obtained from the FactSet database, and other variables are obtained from the CSMAR database. In the data analysis process, the following preprocessing measures are adopted: eliminate enterprise samples from the financial and real estate industries; delete enterprise records marked as ST or PT and other special circumstances; exclude observation data with missing values of core variables; conduct boundary correction on all continuous variables with the 1% quantile threshold to reduce the impact of extreme values on statistical results. After multiple data cleaning processes, a research sample set containing 11,791 valid observations is finally formed.

### 4.2. Variable definition

#### 4.2.1. Explained variable

This study selects enterprise new quality productivity (Npro) as the core research variable, aiming to analyze its operation mechanism and practical significance in the innovation-driven development strategy, and establish a corresponding theoretical analysis framework. According to the research

results of Jiang Liqun et al [16]., the entropy method is used to set standardized weights for the evaluation index system, so as to construct a systematic evaluation model. Table 1 details the data sources and economic connotations of each dimension index.

Table 1. Variable definition table of new quality productivity

Factor	Sub-factor	Index	Index Value Description	Weight
Labor Force	Living Labor	Proportion of R&D Personnel Salary	R&D Expenses - Salary and Welfare/Operating Income	28
		Proportion of R&D Personnel	Number of R&D Personnel/Number of Employees	4
		Proportion of Highly Educated Personnel	Number of Personnel with Bachelor's Degree or Above/Number of Employees	3
	Materialized Labor (Object of Labor)	Proportion of Fixed Assets	Fixed Assets/Total Assets	2
		Proportion of Manufacturing Expenses	After deducting cash paid for goods and employee compensation expenses, summarize the total cash outflow from operating activities with depreciation of fixed assets, amortization of intangible assets and impairment provision, and calculate the proportion of cash outflow from operating activities in the total sum accordingly.	1
Production Tools	Hard Technology	Proportion of R&D Depreciation and Amortization	R&D Expenses - Depreciation and Amortization/Operating Income	27
		Proportion of R&D Rental Expenses	R&D Expenses - Rental Expenses/Operating Income	2
	Soft Technology	Proportion of Direct R&D Input	R&D Expenses - Direct Input/Operating Income	28
		Proportion of Intangible Assets	Intangible Assets/Total Assets	3
		Total Asset Turnover	Operating Income/Average Total Assets	1
	Reciprocal of Equity Multiplier	Owner's Equity/Total Assets	1	
New Quality Productivity			-	100

#### 4.2.2. Explanatory variable

This study discusses enterprise supply chain stability (Stability) from the perspective of suppliers. The data source adopts the research framework of Jiang Dianchun and Lu Dayu, Dong Hao and Yan Qing [9, 11, 17], and defines supply chain stability as a comprehensive indicator of the proportion of high-frequency cooperative suppliers in the total number of suppliers in a specific year, so as to measure the stability and risk resistance capacity of the supply chain network.

### 4.2.3. Control variables

This study selects a number of core control variables for systematic investigation according to existing literature [18]. Company size is measured by the natural logarithm of annual total assets to measure the enterprise operation scale; asset-liability ratio is determined by the ratio of total liabilities to total assets, reflecting the financial leverage and solvency of the enterprise; return on equity is calculated by the ratio of net profit to average balance of shareholders' equity to evaluate enterprise profit efficiency; inventory proportion is calculated by the proportion of net inventory to total assets, revealing the characteristics of current asset structure; board size is directly presented by the number of board members to reflect the characteristics of governance mechanism; the proportion of independent directors is reflected by counting the proportion of independent directors in all directors to reflect the effect of external supervision; equity concentration describes the ownership distribution pattern based on the shareholding ratio of the top ten shareholders; Tobin's Q value constructs a comprehensive index combining market value and book value to quantify the real economic value of the enterprise; enterprise establishment time is characterized by the logarithm of listing years to represent the experience effect; intangible asset density is defined as the proportion of assessed value of intangible assets to total assets, reflecting the level of innovation capability. The above variables jointly form a multi-dimensional framework system, aiming to enhance the model explanatory power and optimize the result robustness.

### 4.3. Model design

This study uses the following econometric model for empirical analysis to verify the rationality of research hypothesis H1:

$$Npro_{i,t} = \alpha_0 + \alpha_1 Stability_{i,t} + \sum CONTROL_{i,t} + \mu_i + \gamma_t + \varepsilon_{i,t} \quad (1)$$

In model (1), variables  $i$  and  $t$  represent the unique identifier of the enterprise individual and the time series dimension respectively. The dependent variable  $Npro$  measures the quality level of enterprise innovation achievements, and the independent variable  $Stability$  is the core explanatory variable used to evaluate the mechanism of supply chain stability on enterprises. To enhance the rigor and accuracy of regression analysis, this study incorporates a number of control variables, and introduces firm fixed effects and year dummy variables to offset possible omitted variable bias and other interference factors. Finally, the random disturbance term  $\varepsilon$  is also included in the model construction framework.

## 5. Analysis of empirical results

### 5.1. Descriptive statistics

The descriptive statistical analysis in Table 2 shows that when  $Npro$  is set as the dependent variable, its mean value is 5.414, the median is 5.077, and the standard deviation is as high as 2.530. These data characteristics reveal that there are significant differences in the development level of new quality productivity among Chinese enterprises, and there is a certain gap between their current actual performance and potential improvement space, which fully reflects the heterogeneity of the progress of various enterprises in this field.

Table 2. Descriptive statistics

Variable	Number of Samples	Mean	Standard Deviation	Minimum	Median	Maximum
Npro	11791	5.414	2.530	0.811	5.077	14.920
Stability	11791	0.547	0.430	0	0.600	1
Size	11791	22.730	1.273	18.480	22.600	26.410
Lev	11791	0.460	0.200	0.011	0.462	0.911
ROE	11791	0.0557	0.152	-0.783	0.0686	0.364
Inv	11791	0.131	0.116	0	0.105	0.625
Board	11791	2.142	0.202	0	2.197	2.708
Indep	11791	37.460	5.404	0	36.360	57.140
Top	11791	0.568	0.153	0.036	0.573	0.892
TobinQ	11791	1.976	1.313	0.625	1.539	8.321
Age	11791	2.409	0.710	0	2.565	3.367
Inta	11791	0.046	0.049	0	0.0327	0.310

## 5.2. Benchmark regression

Table 3 systematically presents the core findings of this study. Column (1) shows the preliminary correlation characteristics between the "Stability" variable and the dependent variable without adding control variables; Column (2) re-estimates based on the complete set of control variables combined with individual and time fixed effects. The study shows that in the initial model, the regression coefficient corresponding to the "Stability" index is 0.0601, showing a positive relationship at the 5% significance level; after further incorporating all control variables and applying the fixed effect model, the coefficient is adjusted to 0.0524, which remains statistically significant. The above results indicate that high supply chain stability has a positive effect on enterprise new quality productivity, thus verifying research hypothesis H1. This phenomenon can be attributed to the efficient operation environment and technological innovation support brought by a stable supply chain network for enterprises, thereby promoting the continuous improvement of their new product development capabilities.

Table 3. Regression results of supply chain stability and new quality productivity

Variable	Npro	
	(1)	(2)
Stability	0.0601** (2.34)	0.0524** (2.21)
Constant	5.3566*** (296.81)	4.0765*** (3.49)
Controls	NO	YES
Year	YES	YES
Firm	YES	YES
N	11791	11791
Adj. R <sup>2</sup>	0.8211	0.8472

Note: Values in parentheses are t-values; \*, \*\*, \*\*\* indicate significance at the 10%, 5% and 1% levels respectively

### 5.3. Grouped regression

Table 4. Grouped regression results of trade credit financing

	(1)	(2)
Variables	High Trade Credit Financing Group	Low Trade Credit Financing Group
	Npro	Npro
Stability	0.0210 (0.682)	0.0699** (2.260)
Constant	4.114* (1.813)	4.292 (1.626)
Controls	YES	YES
Year	YES	YES
Firm	YES	YES
N	5,780	5,674
Adj. R <sup>2</sup>	0.892	0.882

This study conducts grouped regression tests based on trade credit financing to explore the differential moderating effect of supply chain stability on new quality productivity. According to the empirical results, in the high trade credit financing group, the regression coefficient of supply chain stability is 0.0210, with a t-value of 0.682, and the test result is not significant. In the low trade credit financing group, the regression coefficient of supply chain stability is 0.0699, which is significantly positive at the 5% level.

This result verifies the driving effect of supply chain trust on the financing mechanism. Enterprises with low trade credit financing have difficulty obtaining formal bank credit support, face strong external financing constraints, and are highly dependent on the supply chain capital market. Stable supply chain relations can significantly improve the trust level of upstream and downstream, alleviate information asymmetry and performance risk, improve enterprise financing constraints, and then effectively promote the development of new quality productivity. Enterprises with high trade credit financing have obtained sufficient supply chain credit support, with less financing constraint pressure, and the marginal improvement effect brought by supply chain stability is greatly attenuated, so the driving effect on new quality productivity is no longer significant.

### 5.4. Robustness tests

#### 5.4.1. Propensity score matching (PSM)

Following the research design of Zhang Ruichen et al. [19], this study uses the Propensity Score Matching (PSM) method to process the original data, and verifies the stability of the research conclusions through re-regression analysis. Construct a covariate set based on the control variables in model (1) to evaluate the propensity score of the target individual participating in the experiment; complete data pairing with the nearest neighbor 1:1 ratio matching strategy. The results based on post-matching regression analysis are presented in Table 5 (Columns 1 and 2). Even when incorporating more control variables or using the difference-in-differences method and fixed effect

model for further testing, the "Stability" index still maintains high robustness, reaching standard values of approximately 0.0614 and 0.0537 respectively, and passes the statistical tests at the 1% and 5% significance levels in turn, thus effectively proving the high reliability of the research findings.

#### 5.4.2. Lag of core explanatory variable

Considering that the effect of supply chain stability on new quality productivity has both short-term volatility and significant time series characteristics, this study selects the lagged one-period index "Stability" to construct an econometric model to improve the robustness of empirical analysis results. As shown in Table 5 (3) and Table 5 (4), the coefficient of the lagged variable introduced into the regression model is 0.0700, and passes the statistical test at the 1% significance level. This finding further confirms the reliability of the research hypothesis and the consistency of theoretical derivation.

#### 5.4.3. Changing the research interval

To further explore the impact mechanism of the sharp stock market fluctuation in 2015 and the COVID-19 pandemic in 2020 on supply chain stability, this study eliminates the data samples of relevant years in the empirical analysis and conducts robustness tests. Columns (5) to (8) of Table 5 present the core regression model results obtained based on the optimized data set, and its key independent variables still maintain statistical significance at the 5% significance level, thus fully confirming the reliability and universality of the research conclusions.

Table 5. Robustness test results

Variable	Npro		Npro		Npro		Npro	
			Lagged One Period of Explanatory Variable		Excluding 2015 Data		Excluding 2020 Data	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Stability	0.0614* *	0.0537* *	0.0689**	0.0700***	0.0583**	0.0485**	0.0796** *	0.0733** *
	(2.320)	(2.235)	(2.34)	(2.58)	(2.19)	(2.00)	(2.74)	(2.74)
Constant	5.315** *	3.392*	5.4483***	5.3475***	5.3890** *	4.1519** *	5.3098** *	4.0146** *
	(358.8)	(1.904)	(270.79)	(3.41)	(287.62)	(3.29)	(261.56)	(3.19)
Controls	NO	YES	NO	YES	NO	YES	NO	YES
Year	YES	YES	YES	YES	YES	YES	YES	YES
Firm	YES	YES	YES	YES	YES	YES	YES	YES
N	10249	10249	8041	8041	10774	10774	10354	10354
Adj. R <sup>2</sup>	0.859	0.880	0.8482	0.8699	0.8312	0.8560	0.8081	0.8357

Note: Values in parentheses are t-values; \*, \*\*, \*\*\* indicate significance at the 10%, 5% and 1% levels respectively

#### 5.5. Heterogeneity tests

Although the benchmark regression results confirm the important role of supply chain stability in enterprise innovation output, the response characteristics among different types of enterprises show

significant heterogeneity. An in-depth exploration of the driving mechanism behind this heterogeneity can deepen the understanding of the impact mechanism of supply chain stability in specific business scenarios. Based on this, this study selects two core variables of supply chain concentration and financial constraint level as the entry points, systematically analyzes how supply chain stability promotes new quality productivity by affecting innovation behavior, and clarifies its internal logical chain.

### 5.5.1. Supply chain concentration

Although the improvement of supply chain integration enhances the influence of core cooperative enterprises, it also increases the potential risks of enterprises in operational efficiency and innovation practice [20]. A stable supply-demand relationship helps alleviate the uncertain factors of the external environment and provides a more stable and sustainable support foundation for enterprise technological innovation.

Following the analysis framework proposed by Wu Aiqi et al. [21], this study adopts the average value of sales revenue from the top five customers and procurement expenditure from suppliers as the core index to comprehensively explore the mechanism of supply chain concentration on enterprise new quality productivity. Based on this, the interaction term of stability index Stability and supply chain concentration SCC is introduced to further examine how supply chain stability moderates the correlation effect between the two under different scenarios. The empirical results show (Column (1) of Table 6) that when Stability is positive, the variable is significantly positively correlated with the development level of enterprise new quality productivity ( $t=2.83$ ,  $p<0.05$ ), verifying the promoting effect of supply chain stability on innovation capability at the overall level. At the same time, the regression coefficient of the interaction term  $\text{Stability} \times \text{SCC}$  is 0.00250, showing a positive impact at the 1% significance level ( $F=3.96$ ,  $p<0.05$ ), indicating that supply chain concentration not only improves the organization's ability to adapt to uncertainty by enhancing collaboration stability, but also has a heterogeneous impact on its long-term innovation performance.

### 5.5.2. Degree of financing constraints

Studies show that enterprises with high financing constraints often face multiple operational dilemmas such as capital shortage and blocked technological innovation [22]. In this case, a stable supply chain network can provide liquidity support for enterprises through trade credit or supply chain finance mechanisms, thus effectively maintaining the continuity of daily operations and further promoting the innovation vitality of enterprises and the development potential of new production factors. To deeply analyze the mechanism of financing constraints, this study introduces the interaction term of stability index (Stability) and financing constraint index (SA) as the core variable for regression analysis. The results show that when examined separately, the regression coefficient of Stability is 0.0515, showing a positive correlation at the 5% significance level; after incorporating the interaction term, the regression coefficient of  $\text{Stability} \times \text{SA}$  reaches 0.385, showing a significant positive value at the 1% significance level. This indicates that under tight financing conditions, the stability of the supply chain network has a more significant effect on improving enterprise new quality productivity.

Table 6. Heterogeneity tests

	(1)	(2)
Variable	Supply Chain Concentration	Financial Constraint Level
	Npro	Npro
Stability	0.0547** (0.0219)	
Stability×SCC	0.00250* (0.00143)	
SCC	-0.00216 (0.00240)	
Stability		0.0515** (0.0225)
Stability×SA		0.385*** (0.0959)
SA		0.821 (0.580)
Controls	YES	YES
Year	YES	YES
Firm	YES	YES
N	11,408	11,203
Adj. R <sup>2</sup>	0.883	0.878

Note: Values in parentheses are t-values; \*, \*\*, \*\*\* indicate significance at the 10%, 5% and 1% levels respectively

## 6. Conclusions and policy suggestions

Taking Chinese A-share listed companies from 2011 to 2023 as samples, this study conducts an empirical analysis and draws the following main conclusions: the stability of the supply chain system has a significant promoting effect on enterprise innovation and production efficiency, and this effect persists after multiple robustness tests. Further heterogeneity analysis shows that this positive correlation is particularly prominent in the special scenarios of high supply chain concentration and strong financing constraints. From the perspective of supply chain, this paper deepens the understanding of the generation mechanism of new quality productivity, not only enriches the theoretical connotation of related fields, but also provides important reference basis and practical guidance value for practical decision-making.

Based on the above research conclusions, this paper puts forward the following policy implications:

In view of the significant positive promoting effect of supply chain stability on the development of new kinetic energy of enterprises, the government should focus on strengthening the construction of collaborative system of supply chain networks in key industries and fields, and improve their risk resistance and integration efficiency. This is not only conducive to stimulating the innovation potential of enterprises, but also can accelerate the cultivation and development process of new productivity factors.

Government functional departments should systematically build a dynamic monitoring and early warning mechanism for supply chain concentration risks, and guide core enterprises to give full play to the role of "chain leaders". The collaboration efficiency and stability of cooperative relations between upstream and downstream enterprises in the industrial chain can be improved by establishing industrial alliances, signing strategic agreements and promoting data sharing.

Based on the influence mechanism of financing constraints on enterprise supply chain resilience and innovation efficiency, the government can encourage financial institutions to explore innovative supply chain financial products and services (such as factoring financing and accounts receivable pledge) through policy means, so as to effectively alleviate the liquidity dilemma of enterprises. It is particularly urgent to establish a unified supply chain financial service information system covering the whole industry, which will not only help reduce the risk of multiple credit granting, but also optimize the robustness of the overall industry credit management system.

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