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New-Quality Productive Forces and Corporate Supply Chain Resilience

Yining Xu

Financial Engineering, Ningbo University, Ningbo, China
2587669657@qq.com

Abstract. Currently, the security and stability of supply chains have become central issues for corporate survival and even national strategy, and new-quality productivity offers new possibilities for addressing supply chain vulnerabilities. Based on data from Chinese A-share listed companies from 2012 to 2023, this study empirically examines the impact of new-quality productive forces on corporate supply chain resilience. The findings reveal that, first, new-quality productive forces can significantly enhance corporate supply chain resilience. Second, new-quality productivity enhances supply chain resilience by improving firms' total factor productivity and innovation efficiency. Third, for firms without general deficiencies and those not engaged in light-asset operations, new-quality productivity significantly enhances supply chain resilience; however, this effect is not significant for firms with general deficiencies or those engaged in light-asset operations.

Keywords: new-quality productive forces, corporate supply chain resilience, total factor productivity, innovation efficiency

1. Introduction

Right now, the global political and economic landscape has been going through some really profound shifts, what with geopolitical conflicts getting worse, trade protectionism on the rise, and public health emergencies popping up every so often; all of these things together have ended up laying bare the vulnerabilities that exist in corporate supply chains. The older ways of managing supply chains, which tended to focus a lot on efficiency and on linear forms of collaboration, have turned out to be not quite up to the task when it comes to dealing with a highly uncertain external environment. And so, the security and stability of a company's supply chain has come to be seen as a core issue — one that matters not just for a firm's survival but even for national strategy. At the same time, digital technologies are reshaping production methods in a pretty big way; this more advanced kind of productive force does offer some new possibilities for solving the problems caused by fragile supply chains. Putting the development of this new form of productive forces and the building of supply chain resilience (SCR) into the same analytical framework is, on one hand, an inevitable choice if we want to respond to what our era is demanding of us, and on the other hand, it's a logical necessity for pushing relevant theoretical research further along.

Given that kind of backdrop, this study sets out to take a systematic look at how new-quality productive forces (NQPF) affect supply chain resilience (SCR) and what mechanisms lie behind that

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relationship. Getting a good answer to this question will, from a theoretical angle, help us better understand how enterprises go about building up their dynamic adaptive capabilities in this digital age; from a practical angle, it can serve as a reference for government decision-making as they work to build a secure and controllable modern industrial system, while also guiding companies to really internalize NQPF as the core engine that helps their supply chains bounce back from various risks.

2. Literature review

Numerous studies have consistently confirmed that NQPF have a significant positive impact on SCR, and a wealth of mediating mechanisms have emerged to explain this relationship. Based on a dynamic capabilities perspective, Mi Jun et al. [1] found that absorptive capacity plays a positive mediating role between NQPF and supply chain resistance, while adaptive capacity significantly mediates resistance but does not significantly mediate resilience. Furthermore, the level of marketization enhances the positive effect of NQPF on resilience but weakens their effect on recovery capacity; increased market competition strengthens the driving effect on absorptive capacity while weakening the promotional effect on adaptive capacity; and negative media attention inhibits these effects. Mao Xuesong [2] points out that SCR itself mediates the relationship between NQPF and improvements in corporate ESG performance. Wang Ligang et al. [3] Wu Chengcheng [4] respectively confirm the positive effects of NQPF on SCR in commercial and distribution enterprises and general enterprises through pathways such as alleviating financing constraints and enhancing market competitive advantages and innovation capabilities; the latter also found that this impact on SCR exhibits a time lag. Li Liying and her colleagues [5] took things a step further: they went ahead and distinguished between entity-level and relationship-level SCR, and they also identified two key mediating pathways—one has to do with alleviating financing constraints, and the other one can help reduce external transaction costs; Sheng Mingquan et al. [6], for their part, put more emphasis on the mediating roles that total factor productivity and ESG performance tend to play; and Li Mingming and his team [7] identified a three-pronged mechanism, which consists of information channels, external transaction cost channels, and corporate resource allocation channels. Taken together, all of these studies have actually managed to reveal, from multiple dimensions, the intrinsic logic of how new-quality productive forces (NQPF) can empower supply chain resilience (SCR).

Other studies, though, have tended to look more at complex conditions and the kinds of macro-level effects that come along with them. For example, Xu Jun and his colleagues [8] showed that when the digital economy and the real economy get integrated, that integration actually plays a positive moderating role in how NQPF affects the resilience of industrial and supply chains. Huo Weidong et al. [9] took a different approach—they used a spatial econometric model and ended up finding that NQPF do have some pretty noticeable spatial spillover effects; these effects help boost regional SCR mainly by easing up those mismatches in factor allocation, and what's interesting is that non-resource-based cities, non-transportation hub cities, and small-to-medium-sized ones all seem to benefit a lot more from this process. Then there's the work by Mi Jun et al. [10], who employed the fsQCA method and managed to identify four different configuration pathways—these include the "organization-led, high-efficiency empowerment model" and the "technology-environment dual-drive model." Their study also revealed that different regions across China follow their own distinct patterns: the eastern, central, western, and northeastern areas, for instance, show things like the "technology-empowered resource model" and the "organization-environment synergy model," respectively.

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Taken together, these findings give us a fairly solid multidimensional theoretical foundation, along with some useful policy insights, for figuring out how to develop NQPF in ways that fit local conditions, and for making supply chains more secure and resilient at the same time.

3. Research design

3.1. Model specification

This study specifies the following model:

$$Resilience_{it} = \alpha_0 + \beta_0 NQPF_{it} + \sum \gamma_k Control_{it} + \varepsilon_{it} \quad (1)$$

$Resilience_{it}$, $NQPF_{it}$, $Control_{it}$, ε_{it} represent, respectively, SCR, NQPF, a set of control variables, and the error term. α_0 represents the constant term, β_0 and γ_k represent the coefficients of the variables, respectively.

3.1.1. Variable definitions

Regarding the dependent variable, this study follows the approach of Yao Zhenghai et al. [11] in constructing an evaluation index system.

Regarding the core explanatory variable, this study follows the approach of Li Xinru et al. [12] in constructing an evaluation index system for NQPF based on three dimensions: new-quality laborers, new-quality objects of labor, and new-quality means of labor. The study then employs the entropy-weighted TOPSIS model to calculate the weights for each dimension and the composite scores for the sample.

Regarding control variables, this study selected a series of control variables at both the firm level and the macro level, specifically including: (1) Firm-level variables: firm size (Size), firm profitability (ROA), firm leverage (Leverage), firm liquidity (Liquidity), firm age (Age), board size (Board), executive compensation (Salary), concentration of ownership (Top5), and price-to-earnings ratio (PE); (2) Macro-level variables: regional economic development level (GDP), regional industrial structure (Industry), and regional financial development level (Finance).

3.1.2. Data sources and descriptive statistics

This study uses A-share listed companies on the Shanghai and Shenzhen stock exchanges from 2012 to 2023 as the research sample and performed the following preprocessing steps: First, companies labeled as ST, *ST, PT, suspended from trading, or delisted, as well as companies in the financial sector, were excluded; second, samples with a large number of missing data points were excluded; third, to eliminate the impact of outliers on the results, all continuous variables were trimmed at the 5% level; Fourth, the data for each variable were matched and integrated. Regarding data sources, firm-level data were obtained from the Guotai-An database (CSMAR), while macro-level data were sourced from the Wind database. The descriptive statistics for each variable are detailed in Table 1.

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Table 1. Descriptive statistics for variables

VarName	Obs	Mean	SD	Min	Max
Resilience	24662	1.029	0.778	0.013	15.956
NQPF	23339	12.813	7.174	1.220	36.991
Size	25486	3.093	0.061	2.848	3.357
ROA	25485	0.052	0.061	-0.163	0.171
Leverage	22908	1.172	0.564	0.630	4.947
Liquidity	25457	0.780	2.047	-5.723	8.204
Board	17692	8.331	1.646	0.000	17.000
Salary	17644	0.312	0.376	0.005	1.689
Age	25483	9.213	8.380	0.000	27.000
PE	21658	58.711	86.751	6.843	550.452
Top5	25241	0.483	0.187	0.200	0.991
Industry	25691	55.495	10.550	34.500	84.800
GDP	25691	10.775	0.748	6.565	11.818
Finance	25691	1.702	0.440	0.701	2.998

4. Empirical analysis

4.1. Basic regression analysis

As can be seen, with the inclusion of control variables at the firm-level financial, corporate governance, and macroeconomic levels, the regression coefficient for new-quality productivity remains consistently and significantly positive, indicating that new-quality productivity enhances SCR.

Table 2. Basic regression analysis

VARIABLES	(1)	(2)	(3)	(4)
	Resilience	Resilience	Resilience	Resilience
NQPF	0.0270***	0.0223***	0.0240***	0.0218***
	(48.98)	(39.24)	(32.40)	(29.77)
Size		5.5365***	6.5655***	5.7671***
		(52.37)	(36.15)	(31.59)
ROA		0.1992**	0.4096***	0.5801***
		(2.07)	(3.12)	(4.49)
Leverage		-0.0141**	-0.0191**	-0.0149*
		(-2.35)	(-2.15)	(-1.70)
Liquidity		0.0003	-0.0005	-0.0010
		(0.20)	(-0.25)	(-0.57)
Board			-0.0168***	-0.0091**
			(-4.27)	(-2.34)

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Table 2. (continued)

Salary			0.1869***	0.1361***
			(8.57)	(6.31)
Age			0.0014	-0.0037***
			(1.05)	(-2.70)
PE			0.0002***	0.0002***
			(3.27)	(3.65)
Top5			-0.3034***	-0.2267***
			(-7.92)	(-6.01)
Industry				0.0190***
				(17.17)
GDP				0.1432***
				(10.10)
Finance				-0.1374***
				(-6.68)
Constant	0.7060***	-16.3541***	-19.3758***	-19.3106***
	(55.56)	(-50.07)	(-34.75)	(-34.73)
Observations	22,598	20,258	14,215	14,211
Number of enterprises	4,231	4,136	2,860	2,857

Note: z-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

4.2. Robustness analysis

First, the dependent variable was replaced; following the approach of Su, Zhenfang et al. [13], SCR of manufacturing firms was comprehensively measured. Second, lagged terms of the independent variables were employed. Third, a two-way fixed-effects model was employed. The results show that the regression coefficient for NQPF remains consistently and significantly positive, indicating that NQPF do indeed enhance SCR.

Table 3. Robustness analysis

VARIABLES	(1)	(2)	(3)
	Replace the dependent variable	Using lagged explanatory variables	Using a two-way fixed effects model
NQPF	0.0007***		0.0131***
	(12.13)		(16.76)
lag_ NQPF		0.0108***	
		(11.50)	
Size	0.4178***	6.3730***	4.7995***
	(31.74)	(28.10)	(20.63)
ROA	0.0970***	0.6554***	0.4709***
	(10.18)	(4.07)	(3.61)

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Table 3. (continued)

Leverage	-0.0023***	-0.0119	-0.0019
	(-3.30)	(-1.09)	(-0.21)
Liquidity	0.0003*	-0.0028	-0.0001
	(1.80)	(-1.24)	(-0.06)
Board	0.0001	-0.0125**	0.0004
	(0.28)	(-2.54)	(0.11)
Salary	0.0082***	0.1440***	0.0725***
	(4.82)	(5.19)	(3.11)
Age	0.0004***	-0.0055***	-0.0344***
	(4.20)	(-3.41)	(-2.64)
PE	0.0000***	0.0002**	0.0000
	(4.39)	(2.35)	(0.67)
Top5	-0.0014	-0.2290***	-0.1596***
	(-0.51)	(-4.92)	(-3.80)
Industry	0.0002**	0.0194***	-0.0013
	(2.37)	(14.45)	(-0.53)
GDP	0.0056***	0.1345***	0.0822
	(6.68)	(8.02)	(1.52)
Finance	0.0018	-0.1704***	0.0611*
	(1.34)	(-6.83)	(1.93)
Constant	-1.2113***	-20.8938***	-15.0949***
	(-30.23)	(-30.04)	(-16.69)
Observations	8,771	10,613	14,211
Number of enterprises	1,949	2,496	2,857

Note: z-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

4.3. Mechanism analysis

To dig deeper into how NQPF really affects SCR from the inside, this study looks at the issue from two angles: one is total factor productivity, and the other is innovation efficiency.

When it comes to a company's total factor productivity, we've used the LP method to estimate it. What we found—shown in columns (1) and (2) of Table 4—is that NQPF can actually help boost SCR by raising a firm's total factor productivity.

As for corporate innovation efficiency, we've taken the number of patent applications per unit of R&D investment as a broad measure of how efficient a company's innovation really is. And from columns (3) and (4) of Table 4, you can see that NQPF is also able to enhance SCR, and it does so by improving a firm's innovation efficiency.

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Table 4. Mechanism analysis

VARIABLES	(1)	(2)	(3)	(4)
	TFP_LP	Resilience	InnoEff	Resilience
NQPF	0.0010*	0.0227***	0.0013***	0.0207***
	(1.83)	(29.38)	(15.29)	(27.34)
TFP_LP		0.2367***		
		(19.56)		
InnoEff1				0.2707***
				(3.61)
Size	11.4573***	3.2460***	0.4882***	5.9977***
	(82.68)	(13.82)	(23.52)	(29.94)
ROA	2.9269***	-0.1307	-0.0084	0.5480***
	(30.34)	(-0.93)	(-0.53)	(4.07)
Leverage	-0.0050	-0.0149	-0.0031***	-0.0119
	(-0.78)	(-1.64)	(-2.75)	(-1.28)
Liquidity	-0.0007	-0.0006	-0.0005*	-0.0006
	(-0.54)	(-0.30)	(-1.93)	(-0.33)
Board	-0.0004	-0.0115***	-0.0004	-0.0090**
	(-0.15)	(-2.84)	(-0.88)	(-2.21)
Salary	-0.7570***	0.3253***	-0.0046*	0.1755***
	(-45.05)	(12.84)	(-1.73)	(7.25)
Age	0.0066***	-0.0046***	-0.0002	-0.0037**
	(6.22)	(-3.29)	(-1.42)	(-2.46)
PE	-0.0003***	0.0003***	0.0000	0.0002***
	(-8.12)	(5.01)	(1.32)	(3.17)
Top5	0.0300	-0.2048***	-0.0041	-0.2079***
	(1.07)	(-5.29)	(-0.91)	(-5.13)
Industry	0.0045***	0.0170***	-0.0001	0.0198***
	(5.37)	(14.95)	(-1.04)	(16.78)
GDP	0.0806***	0.1157***	0.0220***	0.1278***
	(7.30)	(8.05)	(15.14)	(8.30)
Finance	-0.0320**	-0.1173***	0.0065***	-0.1785***
	(-2.06)	(-5.49)	(2.77)	(-8.28)
Constant	-28.1178***	-13.1479***	-1.5880***	-19.8737***
	(-66.56)	(-19.63)	(-25.10)	(-32.41)
Observations	13,202	13,074	13,162	12,934
Number of enterprises	2,867	2,775	2,875	2,735

Note: z-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

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4.4. Heterogeneity analysis

This study then goes on to look at how NQPF affects SCR in different ways, depending on a company's corporate governance quality and the way it runs its asset operations. What we found is that for firms without any general deficiencies and for those that don't operate on a light-asset model, NQPF does have a significant ability to boost SCR; but for firms that do have general deficiencies or that do run on a light-asset model, this effect just isn't significant. So here's why that happens:

Table 5. Heterogeneity analysis

VARIABLES	(1)	(2)	(3)	(4)
	There are general defects	There is no general defect	Light asset operation	Non-light asset operation
NQPF	0.0063	0.0219***	0.0386	0.0191***
	(1.45)	(29.66)	(1.45)	(24.40)
Size	4.2847***	5.7711***	-4.0833	5.3559***
	(4.61)	(31.47)	(-0.31)	(22.32)
ROA	0.4559	0.5757***	3.7336	0.6185***
	(0.72)	(4.43)	(1.23)	(4.57)
Leverage	-0.0385	-0.0143	0.3329	-0.0005
	(-0.71)	(-1.61)	(0.95)	(-0.05)
Liquidity	-0.0001	-0.0010	-0.0362	-0.0015
	(-0.01)	(-0.55)	(-0.95)	(-0.83)
Board	-0.0476**	-0.0091**	-0.1426	-0.0031
	(-2.46)	(-2.33)	(-0.65)	(-0.71)
Salary	0.0802	0.1377***	-0.6504	0.0983***
	(0.53)	(6.35)	(-1.03)	(3.99)
Age	-0.0027	-0.0038***	-0.8102*	-0.0105**
	(-0.48)	(-2.73)	(-1.99)	(-2.20)
PE	0.0001	0.0002***	0.0031	0.0001**
	(0.30)	(3.53)	(1.45)	(2.12)
Top5	-0.4748***	-0.2251***	0.7209	-0.2149***
	(-2.86)	(-5.93)	(0.29)	(-4.92)
Industry	0.0029	0.0190***	0.0958	0.0192***
	(0.46)	(17.08)	(0.66)	(10.89)
GDP	0.1287***	0.1421***	10.2884**	0.3725***
	(2.70)	(10.00)	(2.34)	(7.37)
Finance	0.2089	-0.1356***	0.2742	-0.2219***
	(1.25)	(-6.56)	(0.18)	(-8.18)
Constant	-13.6916***	-19.3149***	-99.8292	-20.3591***
	(-4.77)	(-34.58)	(-1.29)	(-23.45)
Observations	100	14,111	55	13,982

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Table 5. (continued)

Number of enterprises	81	2,854	32	2,834

Note: z-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

5. Conclusion

According to the data of Chinese A-share listed companies from 2012 to 2023, the present research investigates the influence of NQPF on SCR. The results show that firstly, NQPF can effectively improve SCR and this conclusion is also supported by several robustness tests such as changing the dependent variable, using lagged explanatory variables, and applying a two-way fixed-effects model. Secondly, NQPF increase the SCR by increasing the total factor productivity and innovation efficiency. Lastly, for firms without serious defects and those not involving in light-asset business, NQPF have a significant effect on SCR; however, this influence is not obvious for firms with serious defects or those in light-asset business.

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