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Digital Trade and Governance of Global Value Chain Resilience

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Abstract

Global value chains are shifting from efficiency-first to security and resilience priority, with digital trade becoming a key force in reshaping governance logic. Based on multiple frontier studies, this research systematically examines the intrinsic relationships among digital technology, digital trade rules, artificial intelligence, and GVC resilience. The findings indicate that digital trade enhances resilience through three mechanisms: risk diversification and supply-demand matching optimization, institutional opening-up and rule network embeddedness, and digital competitiveness improvement and structural constraint mitigation. Key drivers include digital trade rule network status, industrial digitalization, AI application, and new-quality productive forces. Meanwhile, multiple external shocks weaken resilience through rising trade costs, asset-specificity traps, and network modularity lock-in, and the enabling effect exhibits a “Matthew effect.” This research proposes governance pathways including constructing a “China Template” for digital trade rules, advancing institutional opening-up, and strengthening digital infrastructure.

Keywords

Digital Trade; Global Value Chain Resilience; Digital Trade Rule Network; Artificial Intelligence; Institutional Opening-up

1. Introduction

As the nation enters the "15th Five-Year Plan" period, multiple external shocks—including geopolitical conflicts, trade protectionism, and financial volatility—are converging and resonating with one another. These forces are severely disrupting the efficiency-oriented operational logic of global value chains[1]. The frequent emergence of risks such as "supply chain fractures" and "decoupling" is compelling nations to fundamentally re-examine the security and resilience governance of their industrial chains. Concurrently, digital technologies have become deeply embedded within global production networks; new business models—such as cross-border e-commerce and intelligent manufacturing—are flourishing, and digital trade regulations have emerged as a core component in the

restructuring of international economic and trade rules[2]. However, global digital trade regulations currently exhibit a trend toward "fragmentation," characterized by intensifying institutional competition among differing regulatory frameworks. Against this backdrop, exploring how digital trade can be leveraged to enhance value chain resilience has become a critical imperative for China as it advances "institutional openness" and constructs a new paradigm for high-level opening up to the world.

2. Mechanisms by Which Digital Trade Empowers Value Chain Resilience

2.1. Risk Diversification and Optimized Supply-Demand Matching

By enhancing information transparency and reducing search costs, digital trade strengthens enterprises' capacity to allocate resources globally. Drawing upon OECD input-output data, Liu Yue and Shao Yujia found that industrial digitalization significantly bolsters the resilience of upstream and downstream value chains by increasing the dispersion of supply-demand risk exposures[3]. Intelligent manufacturing facilitates precise demand forecasting and inventory optimization, while cross-border e-commerce compresses intermediate costs, thereby achieving the dual objectives of "extending and fortifying" industrial chains. Furthermore, participation in digital global value chains fosters the development of "new quality productive forces," stimulating the agglomeration of high-end production factors and facilitating technology spillovers, which collectively enhance the overall adaptability and recovery capacity of industrial and supply chains[4]. Artificial intelligence, in particular, significantly reinforces the resilience of enterprises within global value chains by elevating production technology standards, optimizing resource allocation efficiency, and promoting the diversification of export markets[5].

2.2. Institutional Openness and Embeddedness within Regulatory Networks

The more prominent a nation's position is within the network of digital trade regulations established through Regional Trade Agreements (RTAs), the greater the resilience of its manufacturing sector's global value chains[6-7]. This positive correlation between network centrality and resilience is realized through two primary channels: an enhanced capacity to control and leverage digital resources, and the optimization of the regulatory environment governing digital trade. Data-opening clauses facilitate the cross-border flow of data elements; environment-facilitating clauses reduce trade friction; and rights-protection clauses bolster confidence in cooperation. Furthermore, the "third-party effect" of the digital trade rules network contributes to an overall enhancement of resilience levels. Huang Ning and Cao Aobo point out that digital technologies—by altering

work processes, creating new objects of trade, and shifting power dynamics—have shaped the differentiated demands of various nations, giving rise to four distinct rule templates: the "American," "European," "Singaporean," and "Chinese" models[2].

2.3. Enhancing Digital Competitiveness and Alleviating Structural Constraints

Based on dynamic factor models and high-dimensional fixed-effects models, Zhang Tianding and Fan Qian identify three categories of structural constraints. First, in the transactional dimension, rising trade costs exacerbate friction in the cross-border substitution of production factors and erode systemic redundancy[1]. Under conditions of multiple simultaneous shocks, enterprises struggle to secure alternative suppliers in the short term, resulting in "substitution rigidity." Second, in the technological dimension, high-tech industries—characterized by a high degree of asset specificity—exhibit reduced elasticity in factor substitution during extreme shocks; this effect actually amplifies the negative impact of the shocks, creating an "asset specificity trap." Third, in the topological dimension, highly modular production networks tend to concentrate nodes within specific communities; the lack of "weak ties" spanning across these communities hinders the outward dissipation of risk, leading to a state of "topological lock-in." The refinement of digital trade rules can alleviate these constraints: cross-border data flows enhance the elasticity of factor substitution; harmonized regulatory standards reduce compliance costs; and the expansion of the rules network breaks down community-based lock-ins.

However, this enabling effect is characterized by a significant "Matthew Effect." Sub-sample regression analyses conducted by Liu Caibin and Shi Enyi reveal that a prominent position within the digital trade rules network significantly enhances the resilience of manufacturing sectors within the global value chains of developed nations, whereas its impact on developing nations remains statistically insignificant[7]. Leveraging their first-mover advantages in digital technology and their central positions within the rules network, developed nations are able to more effectively capitalize on institutional dividends; conversely, developing nations—constrained by underdeveloped digital infrastructure, insufficient regulatory capacity, and a peripheral status within the rules network—struggle to reap the benefits of digital trade, thereby exacerbating the divergence in resilience levels.

3. Governance Pathways

3.1. Constructing a "Chinese Model" System of Digital Trade Rules

Huang Ning and Cao Aobo[2] propose that China should leverage its strengths—particularly in digital infrastructure, e-commerce, and mobile

payments—to construct a "Chinese model" of digital trade rules that is tailored to its specific national conditions. In terms of short-term strategy, it is essential to actively align with high-standard agreements such as the CPTPP and DEPA; promote a tiered management system for data and a "negative list" mechanism; and accelerate the promulgation of a unified, national-level catalog of "important data" to clarify compliance benchmarks and reduce operational costs for enterprises. Concurrently, successful pilot experiences from Free Trade Zones should be scaled up nationwide to facilitate cross-border digital enterprises, all while upholding the principle of data sovereignty. Regarding long-term strategy, China should leverage its expertise in areas such as 5G, the BeiDou Navigation Satellite System, and e-commerce platforms to assist developing nations in building digital infrastructure, thereby enhancing their capacity to participate in global digital trade. Once a greater number of nations have benefited from this "Chinese model," a coalition for rule-making can be established within the WTO to drive the evolution of "Chinese-style" standards from regional practices into global norms.

3.2. Advancing Institutional Opening-up and Integration into Rule-based Networks

China should proactively engage in the construction and expansion of digital trade rule networks within Regional Trade Agreements (RTAs), deepen digital cooperation with RCEP member states and countries along the "Belt and Road" initiative, and promote the mutual recognition of rules alongside regulatory coordination. Research indicates that in countries characterized by lower levels of divergence in regulatory policies, the positive impact of digital trade rule networks on the resilience of value chains is significantly more pronounced[8]. Consequently, China should actively champion the international coordination of digital trade regulatory policies to mitigate institutional transaction costs. Specific pathways for achieving this include: participating in digital trade rule negotiations within the WTO framework; advocating for the expansion of the DEPA at the regional level; and signing high-standard Free Trade Agreements (FTAs) that incorporate dedicated chapters on digital trade at the bilateral level—thereby gradually transitioning from being a mere "recipient" of rules to a "co-creator" of rules.

4. Conclusion

Based on a review of numerous cutting-edge studies, this paper systematically elucidates the underlying logic governing the relationship between digital trade and the governance of value chain resilience, yielding the following key conclusions:

First, digital trade enhances the resilience of global value chains through three core mechanisms. At the micro level, industrial digitalization and the application of artificial intelligence boost enterprises' adaptability and recoverability in the face of external shocks by facilitating risk diversification, optimizing the matching of supply

and demand, and fostering "new quality productive forces" . At the meso level, a nation's elevated standing within the network of digital trade rules established by Regional Trade Agreements (RTAs) significantly reinforces the resilience of manufacturing global value chains by strengthening control over digital resources and optimizing the digital regulatory environment. At the macro level, the refinement of digital trade rules effectively mitigates structural constraints—such as rising trade costs, asset specificity traps, and network modularity lock-in—thereby providing institutional safeguards for resilience governance .

Second, the resilience-enhancing effects of digital trade exhibit significant heterogeneity as well as a pronounced "Matthew Effect." Leveraging their first-mover advantages in digital technology and their central position within the network of global rules, developed nations are able to capitalize more effectively on institutional dividends. Conversely, developing nations—hindered by underdeveloped digital infrastructure and a marginalized status within the global regulatory framework—struggle to reap equivalent benefits, thereby exacerbating existing imbalances in the governance of global value chains. This necessitates that the international community prioritize inclusive development as it advances the governance of digital trade.

Third, China should systematically enhance the resilience of global value chains by focusing on four core strategic pillars: the construction of a "Chinese model," institutional openness, the strengthening of digital infrastructure, and the establishment of a comprehensive system for early warning against compound risks. In the short term, China must actively align itself with high-standard international rules; in the long term, it should promote the internationalization of its domestic regulations while simultaneously assisting developing nations in bridging the digital divide, thereby utilizing multilateral cooperation to counteract the "Matthew Effect".In conclusion, against the backdrop of an increasingly complex global economic and trade environment, only by simultaneously pursuing technological empowerment, institutional openness, and deep integration into the global network of rules can we foster a virtuous cycle of high-quality development and high-level security amidst the ongoing restructuring of global value chains.

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