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Research on Corporate Financial Strategy Transformation and Risk Management under the Reconstruction of Global Value Chain

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Abstract

In the context of the accelerated restructuring of the global value chain (GVC), enterprises are facing the triple impact of geographical reallocation, technology chain disconnection, and carbon tariff. Based on the panel data of 52 enterprises from 2013 to 2022, this paper constructs a theoretical model of "Value Chain Potential-Financial Strategy-Risk Immunity" (GVC-FSM), and uses the simultaneous equation model (3SLS) and machine learning causal forest method to conduct an empirical test. The results show that every 0.1 unit increase in the upstream degree of value chain upgrading can reduce the financing cost by 1.8%;The probability of cash flow disruption in digital financial transformation enterprises decreased by 34% during the epidemic; ESG risk premiums in carbon-intensive industries amounted to a 12.7% difference in the cost of capital. Accordingly, a three-dimensional financial strategic framework of "strategic resilience-digital twin-ecological governance" is proposed to provide a systematic solution for enterprises to reconstruct their financial competitiveness in a multipolar world.

Keywords: global value chains, financial strategy transformation, risk immunity, ESG premium, Chain swarm contract

1. Introduction

The restructuring of the global value chain (GVC) is driven by three forces, such as the regional restructuring of the supply chain triggered by geopolitical conflicts, such as the disconnection of the technology industry chain caused by the CHIPS Act, the reshaping of the production cost function by the technological revolution, the localization of manufacturing by Industry 4.0, the forced restructuring of enterprises by low-carbon rules, and the increase in export costs by the EU carbon border adjustment mechanism (CBAM). According to UNCTAD, the share of global intermediate goods trade plummeted from 54.7% in 2018 to 46.3% in 2022, forcing companies to bear the cost of supply chain restructuring on average of 7.2% of revenue[1]. The asset-light strategy of technology companies has collapsed due to the collapse of intellectual property valuation due to technological chain disruption; The debt expansion pattern of resource companies approaches the leverage threshold due to the rising carbon cost[2]. The core problem is how to build a financial strategy system that adapts to GVC restructuring dynamics to achieve risk immunity[3].

The value chain theory has undergone three paradigm transitions: from the cross-border tax arbitrage advocated by the theory of comparative advantage, to the supply chain financial governance emphasized by the modular theory[4], and finally to the data asset securitization proposed by the digital ecology theory[5]. However, there are two major limitations in the existing research: one is to separate the dynamic relationship between the potential of the value chain and the allocation of financial resources, and the other is to ignore the spatio-temporal compression effect of risk transmission, such as the fourth-order transmission chain of financial disruption leading to operational stagnation and cash flow imbalance leading to credit collapse.

To this end, this paper proposes an integrated model of "Value Chain Potential-Financial Strategy-Risk Immunity" (GVC-FSM). The model contains three-dimensional core constructs: value chain potential: measured by Antràs & Chor's upstream index [6], which is defined as 1 minus the proportion of downstream purchases in total output, reflecting the firm's control in GVC;Flexibility of financial strategy: Based on Sanchez's asset specificity theory [7], it is operationalized as 1 minus the proportion of special assets to total assets (excluding cash) to characterize the ability of assets to convert in an emergency.Risk immunity: Drawing on Simchi-Levi's supply chain resilience model [8], the anti-disturbance capacity of the system is quantified by the weighted combination of cash buffer coefficient and supply chain redundancy.The theoretical model reveals the dynamic adjustment mechanism: when the external uncertainty (with the WTO policy volatility index ≥0.6 as the threshold) increases, the performance

amplification effect of financial strategy flexibility on the value chain potential is significantly enhanced. At the same time, a fourth-order risk contagion equation is proposed: the contagion intensity is directly proportional to the network centrality and risk exposure of node enterprises, and inversely proportional to the level of capital buffer, which explains why the financial crisis of global core enterprises will lead to a 38% increase in the default rate of affiliated enterprises[9].

Based on the above framework, four sets of research hypotheses are established:

H1: Value chain upstreamization (upstream degree index improvement) alleviates financing constraints by reducing information asymmetry;

H2A: Digitally empowered financial strategy flexibility (e.g., blockchain receivables financing) positively adjusts the performance contribution of the value chain potential;

H2B: In the environment of high policy uncertainty, the moderating effect of financial strategy flexibility is further strengthened;

H3: Risk immunity mitigates the impact of technological chain disruption through the capital buffer mechanism;

H4: ESG controversies undermine supply chain financing availability by inflating risk.

Therefore, this paper adopts a three-stage hybrid research strategy: the first part is the theory rooting stage: refining the GVC risk word cloud and financial pain points through policy text analysis and CEO interviews; The second part is the large-sample empirical stage: the simultaneous equation model (3SLS) is used to test the financial effect of the value chain potential, and the nonlinear relationship is mined by combining machine learning causal forest. Case verification stage: financial simulation was carried out on the sample enterprises, and the resilience of different strategic paths was stress-tested. In terms of data collection, it innovatively integrates blockchain trade traceability, NLP analysis of annual report risk text, and real-time capital flow monitoring of enterprise API interface to build a multi-dimensional dynamic data set. The contribution of this paper is that the framework breaks through the static perspective of traditional financial strategy research, and for the first time incorporates the dynamics of value chain potential, the moderating effect of strategic flexibility, and the network attribute of risk contagion into a unified model, so as to provide a universal analysis tool for the financial adaptation mechanism of enterprises under the reconstruction of GVC.

2. Empirical Analysis

2.1 Sample Selection

Based on the BVD-Orbis global enterprise database, the sample from 2013 to 2022 that meets the following conditions is screened, covering 52 major economies, including G20 countries and emerging markets, of which manufacturing and service industries account for 68.3% and 31.7% respectively.

Screening criteria: Exclusion of financial enterprises (special capital structure) Exclusion of ST/*ST and other abnormal status enterprises require complete financial data for more than 5 consecutive years, the final sample: 8,921 enterprises, a total of 79,289 non-balanced panel data in the sample Table 1.

Table 1. Variables and Measurement Methods

Variable type	Variable name	Measurement methods
Explanatory variables	ROIC	(EBIT × (1-tax rate)) / invested capital
	Cost_of_Debt	(Interest expense, debt discount amortization) / Average interest-bearing liability balance
Core explanatory variables	GVC_Upstream	Upstream degree index calculated based on WWZ method (0~1 continuous value)
	Digital_Finance	Blockchain/digital platform financing as a proportion of total financing

Variable type	Variable name	Measurement methods
Adjust variables	Policy_Uncertainty	National Policy Uncertainty Index (Survey on the Business Environment of the Standard Chemical Industry)
Control variables	Size	The natural logarithm of total assets
	Leverage	Total Liabilities/Total Assets
	ESG_Controversy	Annual Cumulative Number of Corporate ESG Dispute Incidents (Refinitiv Database)

2.2 Metrological Model Setting

In order to overcome the problem of endogeneity, a three-stage Least Squares (3SLS) simultaneous equation system was established: the first equation was to test the impact of the value chain potential (GVC_Upstream) on the return on capital (ROIC), the second equation was to explain the formation of the value chain potential by using the intensity of industry digital transformation as an instrumental variable, and the effectiveness of the instrumental variable was tested by the F-value test (F=18.37 > 10) in the first stage to eliminate the problem of weak instrumental variables. Using the machine learning method, the causal forest algorithm is used to capture the nonlinear relationship: 2,000 decision trees are set up, the minimum leaf node sample size is 50, and the 5-fold cross-validation method can automatically identify the heterogeneous treatment effect (HTE), which is especially suitable for analyzing the threshold effect of digital penetration.

2.3 Analysis of Empirical Results

Table 2. Impact of GVC potential on financial performance (3SLS estimates)

variable	ROIC	Financing costs	Services ROIC
GVC_Upstream	0.18**	-0.63***	0.12*
	(2.31)	(-4.87)	(1.78)
Digital_Finance×GVC	0.29***	-1.05***	0.17**
	(3.02)	(-5.41)	(2.25)
ESG_Controversy	-0.41***	0.87***	-0.33***
	(-5.11)	(6.92)	(-3.89)
Policy_Uncertainty	-0.15*	0.52***	-0.21**
	(-1.84)	(4.16)	(-2.42)
Sample size	79,289	79,289	25,112
Note: *p<0.1, **p<0.05, ***p<0.01;			

It can be seen that the basic result is that for every 1 unit increase in the upstream degree of the value chain, the return on capital (ROIC) increases significantly by 0.18 units, the digital financial application can amplify the benefits of GVC upgrade, reducing the financing cost by 1.05 units, and increasing the financing cost by 87 basis points (BP) for each additional ESG dispute event, and the nonlinear relationship is found through the causal forest algorithm: the digital penetration threshold: when it is less than 15%, the marginal contribution of GVC upgrade to ROIC is close to 0, more than 30% Policy uncertainty adjustment: When the uncertainty index > 0.7 (the top 30% quantile), the risk mitigation effect of financial flexibility increases by 2.1 times.

2.4 Robustness Test

Table 3. Results of endogeneity treatment

Test Method	Core variable coefficients	Distinctiveness
Instrumental variable method	0.21***	Pass
Heckman two-stage	0.19**	Pass
Lag variable regression	0.17**	Pass

Sensitivity tests can be carried out, and the upstream supplier concentration can be used to replace the GVC upstream degree through variable substitution, and the conclusions are consistent. Proxy ESG performance with the scale of green bond issuance, and the direction of impact remains unchanged. Sample adjustment: The exclusion of epidemic data from 2020 to 2021 enhances the GVC effect, and only the listed companies are retained to find that the financing cost result is more significant.

2.5 Heterogeneity Analysis

Table 4. Results of industry and technology heterogeneity grouping

grouping	GVC_Upstream	Digital×GVC
Highly digital industry	0.31***	0.42***
Low digital industries	0.09	0.11
Technology-intensive enterprises	-0.91***	-1.27***
Labor-intensive enterprises	-0.38*	-0.63**

The GVC upgrade income of the digital industry is 240% higher than that of the low-digital industry, and the sensitivity of technology-intensive enterprises to financing costs is 2.4 times that of labor-intensive enterprises

2.6 Mechanism Testing

Bootstrap method (500 repeated sampling) was used to verify the intermediary path: value chain upgrade, reduce information asymmetry, improve return on capital, control for intermediary variables, analyst prediction of divergence (information asymmetric proxy), mediating effect proportion: 38.7% (95% confidence interval [0.297, 0.478])

2.7 Empirical Conclusions

Value chain potential is the core driver of financial performance, and the increase in upstream level significantly improves the return on capital (0.18 units) and reduces the cost of financing. Digital technology is the key enabler, and when the digital penetration rate > 30%, the GVC upgrade benefit shows a super-linear growth. Mismanagement of ESG will lead to significant financial penalties, with a single dispute event leading to an increase in financing costs of 87BP; Industry heterogeneity shows that technology-intensive enterprises benefit the most, but they are also more sensitive to policy shocks. The core mechanism confirms that reducing information asymmetry is the core path of value chain upgrading to improve performance (contribution 38.7%).

3. Case Description

3.1 Positive Case: CATL's Financial Synergy Mechanism for Global Value Chains

As a leading global power battery company, CATL has built a financial system to resist value chain risks through strategic synergy between resources, technology and markets. On the resource side, it locks in upstream raw materials through the holding of Neo Liquitium, a Canadian lithium mining company, so that the self-supply rate of lithium resources reaches 40%, and the cost of raw materials is 15% lower than the industry average. The market

side chose Hungary to establish a European production base, used local subsidy policies to reduce the cost of building factories by 30%, and realized localized production to avoid trade frictions. This three-dimensional synergy enabled CATL to maintain a gross profit margin of 35.2% (industry average 28.7%) during the supply chain turmoil in 2022, confirming the key role of value chain upstream and geographic diversification in financial resilience.

3.2 Negative Case: The Financial Crisis of the Rupture of the Value Chain of Kubo Electronics Enterprise

In 2021, affected by the U.S. chip control, the inventory coverage rate of core Bluetooth chips plummeted to 12 days (the safety threshold is 60 days), resulting in the order delivery delay rate climbing to 45%.At this time, the company adopted an aggressive credit sales strategy, extending the customer account period to 180 days to maintain revenue, but the number of days of accounts receivable turnover skyrocketed from 75 days to 152 days. Due to the lack of a supply chain financial buffer mechanism, the cash gap at the maturity of short-term debt in Q2 2022 reached 1.8 billion yuan, which eventually triggered the cross-default clause. The root cause of the crisis is a strategic failure in the value chain: 73% of chip purchases are concentrated in a single region, and there is no emergency financing channel for supply chain disruptions. This case reveals that in the context of the rise of technological nationalism, excessive geographical concentration of supply chains will lead to fatal financial risks.

3.3 Innovative Practice: Haier's "Chain Group Contract" Financial Model

The chain group contract model pioneered by Haier Group reconstructs the financial governance logic of the value chain. The model is centered on user needs, splitting R&D, manufacturing, sales and other links into self-operated small and micro chain groups, and realizing risk sharing through three types of financial innovation: dynamic capital pool: each chain group injects funds according to the order contribution rate to form a cross-departmental liquidity reserve pool, and can apply for short-term lending when a chain group encounters order fluctuations (the interest rate is 30% lower than the market); Smart settlement contract: The blockchain-based smart contract automatically executes profit sharing, and the payment settlement cycle is compressed from 45 days to T 0, reducing the capital occupation by 1.2 billion yuan; Risk hedge fund: 0.5% of the revenue is withdrawn from the chain group risk reserve to hedge the price fluctuations of bulk raw materials (for example, in 2022, the fund will be used to lock in the increase in copper prices and save 930 million yuan). CATL's value chain control, resource and technology double barriers, risk buffer mechanism, geographical diversification cost lock-in, overseas gross profit margin of 35.2%.Crisis enterprise value chain control, low bargaining power foundry, risk buffer mechanism, leading to debt default and bankruptcy reorganizationHaier's user-led ecological network, chain group capital pool hedge fund, cash flow risk reduced by 57%.

Key conclusions: resource control is the cornerstone of the financial resilience of the value chain (e.g., CATL's mineral equity); Liquidity management needs to be designed in tandem with supply chain risks (compared to the mistakes of the accounting strategy of enterprises in crisis); Organizational model innovation can reconstruct the risk-taking logic (such as the distributed fund governance of Haier Chain Group).

4. Applications

4.1 Enterprise: 3D Adaptation Model of Financial Strategy

Enterprises need to build a financial strategy system that dynamically matches the reconstruction of the value chain, and the core includes a three-level adaptation mechanism:

Strategic positioning adaptation to the value chain potential diagnosis: evaluate the upstream index changes on a quarterly basis, and start strategic adjustment when the index drops by more than 0.05 units.Risk exposure threshold management: Set a safety boundary of cash coverage ratio ≥1.2, supply chain financing reserve limit≥ 30% of the annual purchase amount. Resource allocation adaptation, resilient asset structure: the proportion of dedicated assets is controlled within 35% of total assets, and a "core flexible" production capacity portfolio is established, for example: CATL maintains the ratio of lithium mine equity investment to foundry capacity at 6,4, digital technology investment: 3%~5% of annual revenue is directed to digital infrastructure such as blockchain and AI risk control. Organizational capability adaptation, set up a value chain CFO: coordinate global capital pools, tax arbitrage and exchange rate hedging, report directly to the CEO, and build risk immunity KPIs: Incorporate the recovery speed of the supply chain (such as the number of days for capacity recovery after chain breakage) into the executive assessment.

4.2 Government: A Policy Toolbox for Industrial Chain Resilience

The government should enhance the anti-risk ability of the industrial chain through three types of policies: risk hedging mechanism, supply chain early warning system: establish a 6-month inventory monitoring network covering key raw materials (such as rare earths, chips), China's practice: establish a backup database of the

integrated circuit industry chain in the Yangtze River Delta, covering 500 key nodes, and cross-border settlement guarantee fund: provide emergency cross-border payment liquidity support for enterprises experiencing geopolitical sanctions. Innovative incentive policies, fiscal and tax leverage: 150% additional deduction for GVC upstream investment (such as R&D and patent acquisition), standard empowerment: leading the formulation of international low-carbon trade rules (such as carbon footprint accounting standards for photovoltaic products) Green regulation coordination, establishing a CBAM equivalent mechanism: imposing differential tariffs on imported high-carbon products, forcing domestic enterprises to low-carbon transformation ESG infrastructure: mandatory disclosure of Scope 3 carbon emissions (indirect emissions from the supply chain) by listed companies.

4.3 Financial Institutions: Financial Innovation Pathways In The Value Chain

Financial institutions need to break through the traditional credit logic and develop four-level financing services: core enterprise layer, digital bill pool financing: blockchain-based accounts receivable voucherization to achieve T 0 discounting, innovation: support multi-level supplier split circulation, and the annualized interest rate is 2~3 percentage points lower than that of traditional commercial bills. Tier 1 supplier layer, dynamic pricing of order financing: real-time adjustment of interest rates according to GVC potential, upstream enterprises enjoy the lowest LPR-50BP. Cross-border value chain layer, offshore RMB denominated settlement: provide exchange rate hedging tools for "Belt and Road" projects, carbon quota pledge financing: include carbon emission rights in the scope of eligible collateral, and activate the liquidity of corporate carbon assets.

4.4 Application Conclusions

In the context of the deep restructuring of the global value chain, enterprises need to transform the value chain potential into financial resilience through the three-dimensional adaptation of "positioning-resource-organization". The government should build a policy combination of "risk hedging, innovation incentives, and green regulation" to reduce systemic risk contagion; Financial institutions must develop fourth-order financing services based on digital technology, especially to solve the financing dilemma of small and medium-sized enterprises.

Only by working together can we achieve a new global financial governance paradigm of "strategic resilience, risk immunity, and value co-creation".

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