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Trade costs and global value chain positioning in China's manufacturing industry: A systematic literature review

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Abstract: Countries' positioning within global value chains (GVCs) has become critical for determining trade margins and economic influence, with trade costs emerging as a crucial determinant beyond traditional factor endowments and economies of scale. Under the combined influence of the evolution of the international division of labor, trade protectionism, and the COVID-19 pandemic, GVCs have entered a restructuring stage, which presents new trade cost challenges. This systematic literature review examines how trade costs affect China's manufacturing GVC positioning through the analysis of 49 high-quality articles selected from 1,072 initial papers retrieved from Web of Science (1999-2023). The review addresses three fundamental questions: factors affecting China's trade costs along with their measurement methods, trade cost differences across GVC stages, and impact mechanisms on China's manufacturing positioning. The analysis tackles critical methodological challenges, including double-counting problems in traditional trade statistics and transmission mechanisms whereby upstream trade barriers magnify downstream costs. This review provides comprehensive insights into how trade costs influence GVC production divisions, offering theoretical foundations for policy interventions aimed at industrial upgrading.

Keywords: *China's manufacturing industry, Global value chains, GVC positioning, Industrial upgrading, Systematic literature review, Trade costs, Value-added trade, Vertical specialization.*

1. Introduction

With the deepening of the international division of labor, countries have formed global value chain (GVC) division of labor systems where positioning significantly influences trade margins and economic influence. Division of labor in GVCs depends on factor endowments, economies of scale, and increasingly on transaction costs [1]. The growth of vertical specialization in world trade, whereby production processes are fragmented across countries, has fundamentally reshaped global manufacturing [2]. Meanwhile, the magnitude of transaction costs influences firms' choices between internally vertically integrated production and participation in external international production networks [3], with declining costs promoting intermediate goods trade and accelerating GVC fragmentation [4].

To promote China's transformation from a manufacturing country to a manufacturing power, Chinese scholars have increasingly focused on trade costs within the manufacturing industry, proposing various measures for transformation and upgrading. China's manufacturing industry has used labor cost advantages to participate in processing and assembly segments of GVCs, achieving rapid development and preliminary upgrading [5]. However, with the rapid development of intermediate products trade, these products frequently cross national customs multiple times, resulting in substantial double-counting problems in traditional trade statistics. Consequently, trade costs measured based on

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traditional statistics may be distorted, with increased upstream trade barriers being transmitted downstream and magnifying trade costs for downstream nations.

Recent GVC restructuring, driven by the natural evolution of the international division of labor, intensifying trade protectionism, and the COVID-19 impact, has brought new transaction costs and challenges. Global production increasingly organizes through fragmented GVC frameworks, where the selection of a producer country for a particular stage depends not only on production costs but also on trade costs associated with upstream and downstream segments. Therefore, identifying trade cost differences across GVC stages constitutes a key issue for managing restructuring and promoting division of labor toward higher-value positions.

Despite growing attention to GVCs, several critical questions remain unanswered: What factors affect China's trade costs, and how can they be systematically measured? How can differences in trade costs across GVC stages be identified and quantified? What impacts do trade costs have on China's manufacturing positioning within GVCs? This study addresses these questions through a systematic literature review of 49 articles, examining: (1) trade cost theories and measurement methodologies with particular attention to their applicability in fragmented global production networks; (2) methodological innovations and data sources enabling comparison of trade costs across national and industry-specific levels; and (3) the influence mechanisms through which trade costs affect China's manufacturing positioning within GVCs, providing theoretical foundations for policy interventions aimed at industrial upgrading.

2. Methodology

Based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, this study divides the systematic literature review analysis process into several sequential steps (Figure 1). This methodological framework ensures both comprehensive coverage of relevant literature and rigorous quality control in study selection.

2.1. Data Source and Timeframe

This research focuses on two key concepts: trade costs, encompassing both tangible expenses such as tariffs and transportation costs, and intangible costs, including information barriers and cultural differences, and global value chains, referring to production processes decentralized across borders. Using these concepts as keywords, this study conducted a systematic literature search in the Web of Science Core Collection database, restricting results to SCI and SSCI-indexed articles, retrieving 1,072 initial papers.

Through systematic screening applying multiple criteria, including publication period (1999-2023), English language, Business Economics research direction, peer-reviewed journal articles, and thematic relevance to industrial manufacturing contexts, the corpus was refined to 49 articles suitable for systematic analysis. The screening process excluded conference papers, editorial materials, reviews, and articles lacking full-text accessibility or direct relevance to manufacturing GVC participation, ensuring the final corpus maintains both thematic relevance and methodological quality (detailed information is provided in Figure 1).

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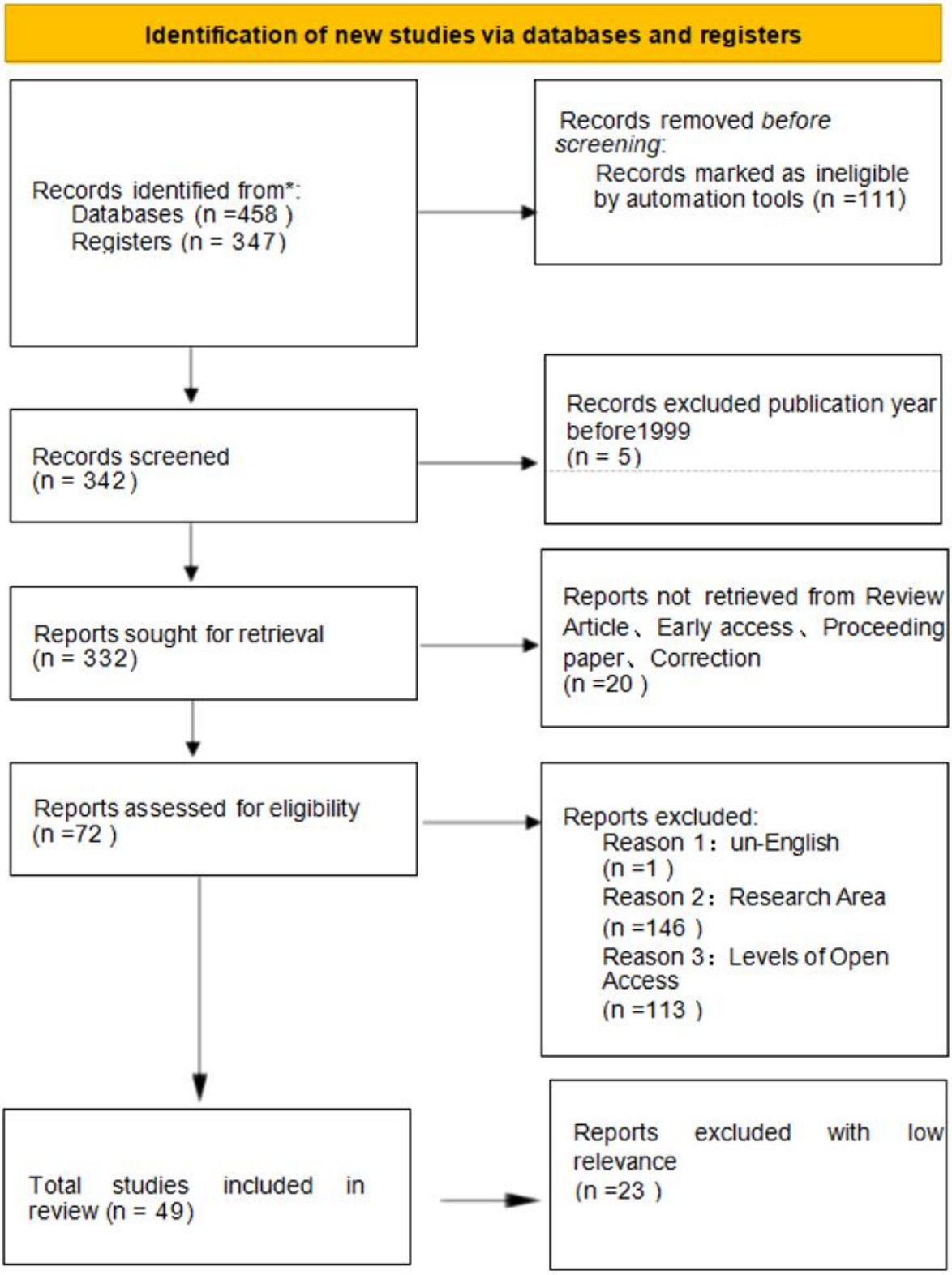

Figure 1.
PRISMA flow diagram for the Global Value Chain systematic literature review.

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3. Findings

3.1. Performance Analysis of Global Value Chain for Trade Costs Research

The level of global value chain specialization in enterprises is no longer solely determined by factor endowments and economies of scale; trade costs have also become a crucial component influencing competitive positioning [1]. To gain real-time and intuitive insights into the latest research trends concerning trade costs and global value chains, this research employs multiple analytical approaches to explore the evolutionary dynamics of research in this field.

3.2. Domain of Global Value Chain for Trade Costs Research

This research narrowed the search scope to literature explicitly discussing the interrelationship between global value chains and trade costs, using the search string TS=("Global value chain" AND "Trade costs") in Web of Science with results restricted to SCI and SSCI-indexed English articles, retrieving 441 papers for initial screening.

The investigation of trade costs and global value chains represents an interdisciplinary research domain. Cross-disciplinary research bridges multiple dimensions, including international trade patterns (as shown in Figure 2), where reducing trade costs promotes production dispersion and improves countries' repositioning within value chains; environmental considerations, where trade costs influence the spatial distribution of production activities and pollution-intensive industries; energy sector dynamics, where trade costs shape resource flows and energy-intensive production geography; technological innovation, where advancements have promoted intermediate goods trade growth and transformed global production networks; and institutional variations, where differences between countries lead to variations in trade costs affecting specialization patterns and the geographical breadth of value chain participation.

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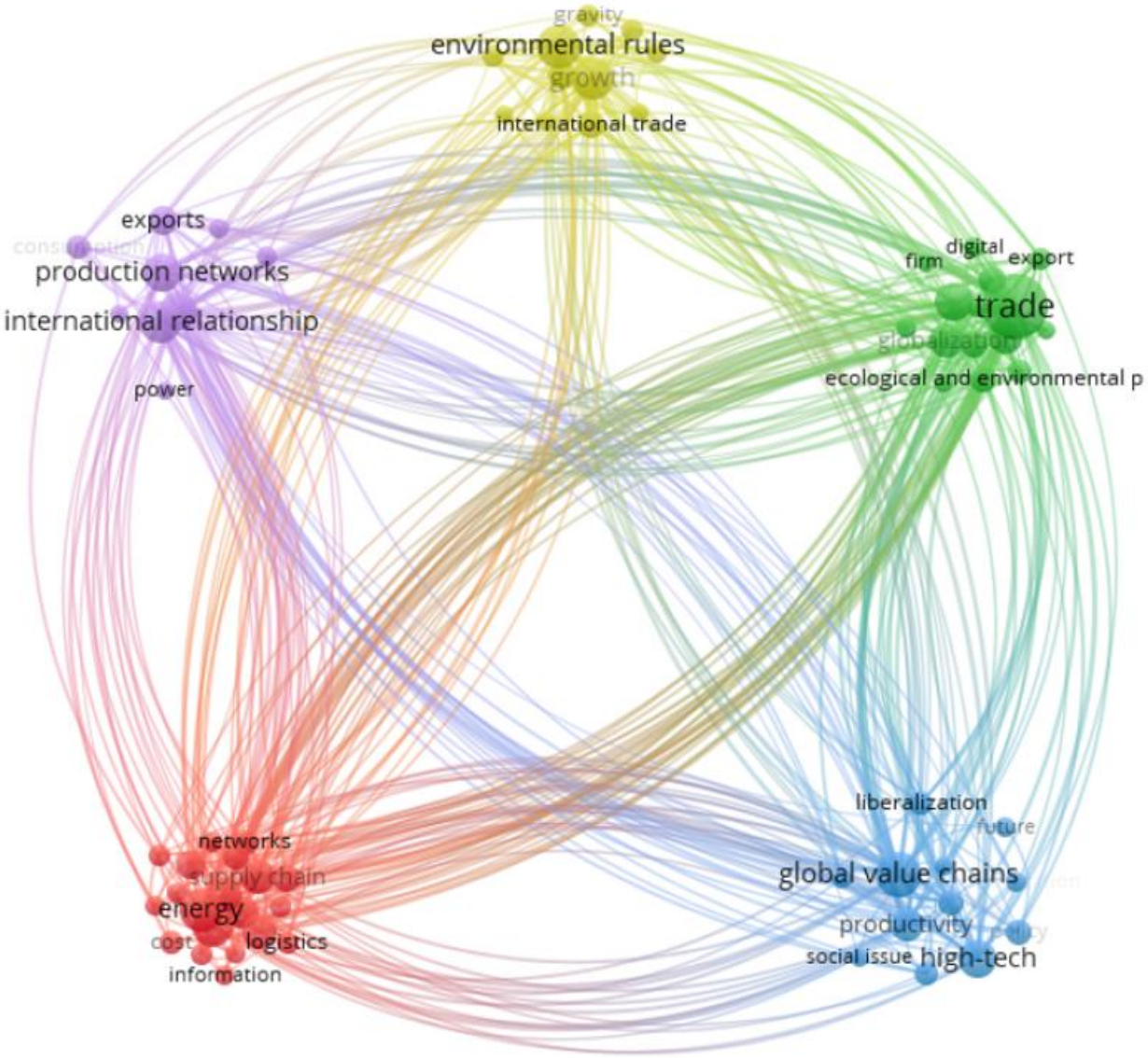

Figure 2.
Analysis of the global value chain + trade costs superposition field.
Source: The author has compiled the results of the Web of Science search.

3.3. Publication Trend of Global Value Chain for Trade Costs Research

This study presents a trend chart portraying publication quantities on the topics of trade costs and global value chain specialization spanning from 1996 to 2023 (see Figure 3). The graph clearly demonstrates a significant growth trend in research literature within this field over the past two decades, with a particularly dramatic acceleration in growth rate beginning in 2016.

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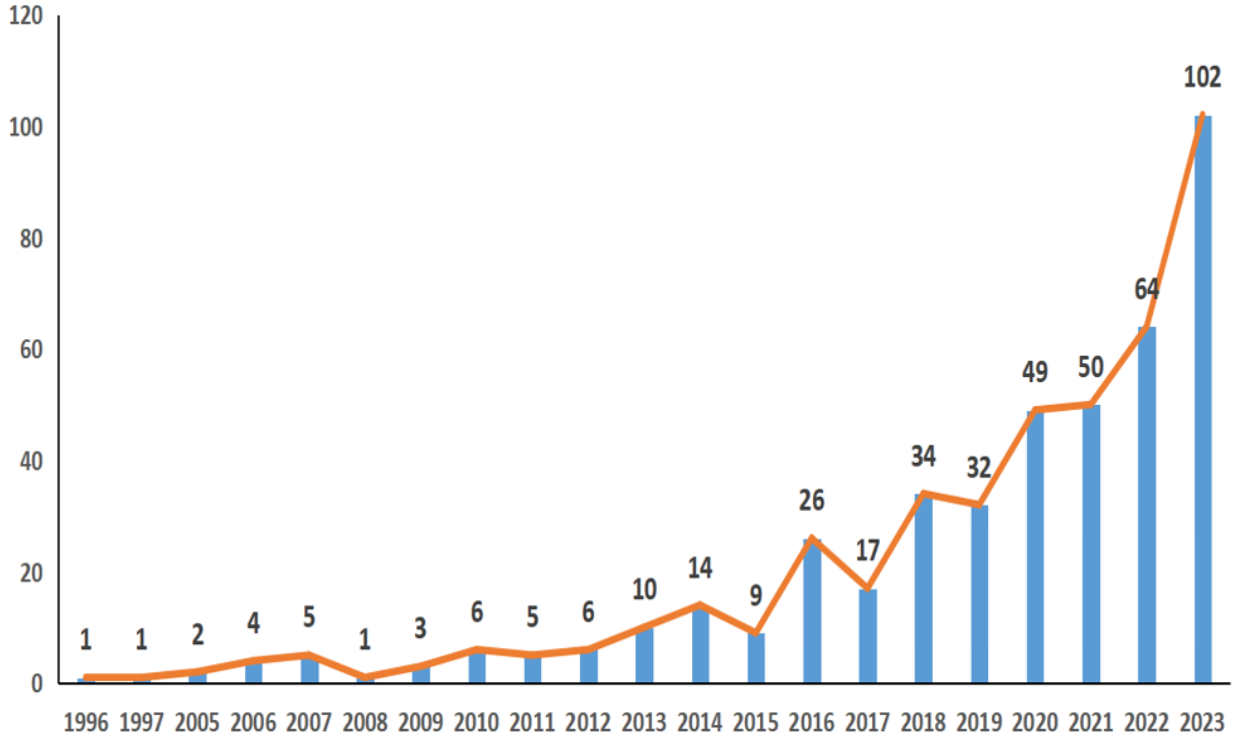

Figure 3.
The number of publications related to global value chains and trade costs from 1996 to 2003.
Source: The author has compiled the results of the Web of Science search.

During the early exploratory phase of research on trade costs and global value chain specialization (1996 to 2009), annual paper output remained limited, indicating that the field was still in its nascent developmental stage. Subsequently, from 2016 to 2023, research activity gradually entered a stable growth trajectory characterized by steadily increasing publication volumes. After 2018, accompanying the rapid changes in the international trade environment and deep adjustments in patterns of international division of labor, related research has exhibited a booming trend. The annual number of published papers rapidly increased from 34 articles in 2018 to 102 articles in 2023, highlighting the growing academic attractiveness of examining the relationship between trade costs and global value chain specialization.

However, overall assessment reveals that research on the interrelationship between trade costs and global value chain specialization remains relatively scarce. Substantial unexplored research gaps and potential innovation opportunities persist in this field, urgently awaiting further exploration and expansion by scholars across disciplines.

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3.4. Towards a New Theoretical Model of Trade Costs and GVC Positioning
3.4.1. Overview of Research Theory

Table 1.
List of research theories in the global value chain literature addressing trade cost issues.

Order	Title	Theories
1	Global value chains and energy-related sustainable practices. Evidence from Enterprise Survey data	Global Value Chains Theory; Industrial Trade Theory
2	Survey of the photovoltaic industry and policy in Germany and China	Global Value Chains Theory; Industrial Trade Theory
3	Spatial lifecycles of cleantech industries – The global development history of solar photovoltaics	Trade Gravity Theory; Industrial Trade Theory
4	Technology gap, global value chain, and carbon intensity: Evidence from global manufacturing industries	Trade Cost Theory
5	Does green growth foster green policies? Value chain upgrading and feedback mechanisms on renewable energy policies	Global Value Chains Theory
6	Tracing carbon footprints to intermediate industries in the United Kingdom	Comparative Advantage Theory
7	Looking into global value chains: influence of foreign services on export performance	Comparative Advantage Theory
8	The entrepreneurial gains from market integration in the new EU member states	Trade Cost Theory
9	Foreign ownership and global city characteristics: unpacking the connectivity of micro-locations	Trade Gravity Theory
10	Offshoring, job satisfaction, and job insecurity	Trade Gravity Theory
11	Factoryless Goods Producers in Japan	Trade Gravity Theory
12	China's electrical equipment manufacturing in the global value chain: A GVC income analysis based on the World Input-Output Database (WIOD)	Global Value Chains Theory
13	Americana without America: rhetorical geography as a source of competitive advantage	Trade Cost Theory; Comparative Advantage Theory
14	Chinese vs. US Trade in an Emerging Country: The Impact of Trade Openness in Chile	Industrial Trade Theory
15	Globalization of Production and Innovation: How Outsourcing is Reshaping an Advanced Manufacturing Area	Circulation Cost Theory
16	Organizing the Global Value Chain: a firm-level test	Transaction Cost Theory
17	Does Value Chain Participation Promote the Adoption of Industry 4.0 Technologies in Developing Countries?	Transaction Cost Theory
18	Do Global Value Chains Improve Economic Upgrading? A Long View	Global Value Chains Theory
19	Does regional value chain participation affect global value chain positions? Evidence from China	Trade Cost Theory
20	Functional Upgrading in China's Export Processing Sector	Industrial Trade Theory
21	The Governance of Global Value Chains: An Analytic Framework	Comparative Advantage Theory
22	The Governance of Global Value Chains: An Analytic Framework	Comparative Advantage Theory
23	Quantifying International Production Sharing at the Bilateral and Sector Levels	Global Value Chains Theory
24	Quantifying International Production Sharing at the Bilateral and Sector Levels	Trade Cost Theory
25	Intermediate Goods Trade: Production Sharing and Value-Added Trade	Global Value Chains Theory
26	Global rivalries, corporate interests, and Germany's 'National Industrial Strategy 2030'	Trade Gravity Theory
27	Integration of African Countries in Regional and Global Value Chains: Static and Dynamic Patterns	Circulation Cost Theory
28	Disconnecting Labour? The Labour Process in the UK Fast Fashion	Industrial Trade Theory; Comparative

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	Value Chain	Advantage Theory
29	Can Developing Countries Gain from Defying Comparative Advantage? Distance to Comparative Advantage, Export Diversification and Sophistication, and the Dynamics of Specialization	Trade Cost Theory; Global Value Chains Theory
30	Chinese SME Development and Industrial Upgrading	Trade Cost Theory; Transaction Cost Theory
31	Opening and linking up: firms, GVCs, and productivity in Latin America	Global Value Chains Theory; Transaction Cost Theory
32	Subcontracting in the Italian industry. Labour division, firm growth and the North-South divide	Transaction Cost Theory
33	Offshore, re-shore, re-offshore: what happened to global manufacturing location between 2007 and 2014?	Global Value Chains Theory
34	From globalising to regionalising to reshoring value chains? The case of Japan's semiconductor industry	Trade Cost Theory
35	Reshoring by small firms: dual sourcing strategies and local subcontracting in value chains	Trade Cost Theory
36	Trade policy and regionalisms in global clothing production networks	Global Value Chains Theory
37	The value of firm linkages in the age of Industry 4.0: a qualitative comparative analysis	Trade Cost Theory
38	Estimating market power for the European manufacturing industry between 2000 and 2014	Industrial Trade Theory
39	A new era is beginning in Central and Eastern Europe: information and communication technology services exceed manufacturing in the global production chain.	Global Value Chains Theory
40	Revisiting High Development Theory to Explain Upgrading Prospects in Business Services Global Value Chains	Global Value Chains Theory
41	Value-Added Exports and U.S. Local Labor Markets: Does China Really Matter?	Global Value Chains Theory
42	"Slicing the Value Chain" Internationally: Empirical Evidence on the Offshoring Strategy by French Firms	Industrial Trade Theory
43	Global Value Chains and U.S. Economic Activity During COVID-19	Global Value Chains Theory
44	The Learning Trap in Late Industrialisation: Local Firms and Capability Building in Ethiopia's Apparel Export Industry	Trade Gravity Theory
45	Implications of foreign direct investment, capital formation, and its structure for global value chains	Global Value Chains Theory
46	Employment effects of joining global production networks: Does domestic value-added matter?	Global Value Chains Theory; Comparative Advantage Theory
47	New patterns in the position of CEE countries in global value chains: functional specialization approach	Global Value Chains Theory
48	Shocks, resilience and regional industry policy: Brexit and the automotive sector in two Midlands regions	Global Value Chains Theory
49	Digitalisation, automation, and upgrading in global value chains – factory economy actors versus lead companies	Global Value Chains Theory

To address the first research question, "What are the factors affecting China's trade costs, and how can they be systematically measured?" this study analyzed the theoretical foundations underlying the 49 selected articles. The analysis revealed that nine articles explicitly involved trade cost theory, among which four articles specifically focused on the measurement of trade costs (as illustrated in Table 1 and Figure 4).

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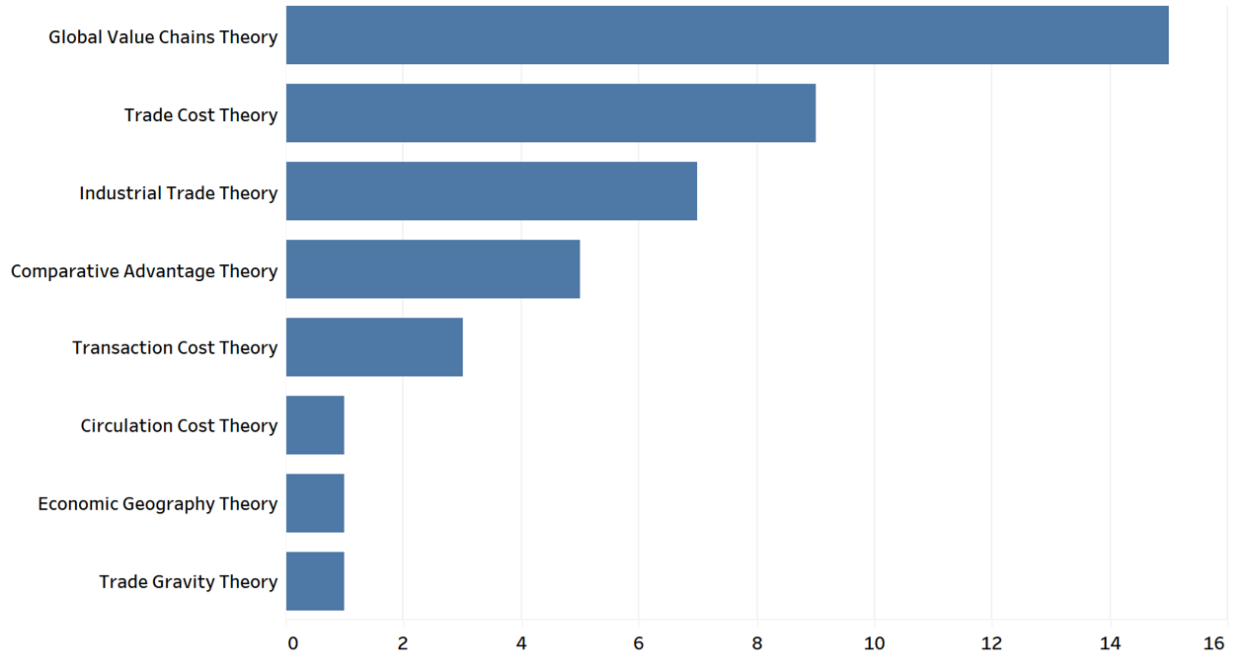

Figure 4.
Theoretical distribution map of global value chain references on trade costs.

Two principal methodological approaches exist for the measurement of trade costs: direct measurement and indirect measurement. However, the direct measurement method faces substantial challenges regarding unified calibration standards for a country's trade costs and difficulties in data collection. Consequently, this research carefully examined literature employing indirect measurement methods. The literature employing indirect methodologies has improved upon traditional gravity models, making these improved models more practical in terms of data accessibility. These improved models demonstrate considerable practical utility, as they can analyze both direct costs (such as tariffs and transportation expenses) and indirect costs (including information barriers, cultural differences, and institutional frictions).

The theoretical foundations identified in the literature corpus encompass several key frameworks. Transaction cost economics provides a fundamental lens for understanding how trade costs influence firms' organizational choices and value chain participation decisions [6]. The gravity model framework, particularly as improved by Anderson and Van Wincoop [7], offers quantitative approaches for estimating bilateral trade costs. Additionally, vertical specialization theory clarifies how trade costs affect the fragmentation of production processes across borders. Gereffi et al. [8] governance framework further clarifies how different coordination mechanisms and power relationships within value chains interact with trade costs to shape countries' positioning opportunities.

The measurement approaches discussed in the reviewed literature reveal important methodological innovations. Indirect measurement techniques, particularly those based on improved gravity models, have gained prominence due to their ability to infer trade costs from observable trade flows while accounting for multilateral resistance terms. These methods enable researchers to decompose aggregate trade costs into policy-related components (tariffs, non-tariff barriers) and natural barriers (transportation costs, geographic distance). Such decomposition proves essential for policy analysis aimed at reducing trade costs and enhancing countries' positions within global value chains.

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3.5. Diversity of Methods and Research Data

The systematic review of methodological approaches employed across the 49 articles reveals substantial diversity in both analytical techniques and data sources, reflecting the multifaceted nature of investigating trade costs and global value chain positioning in Figure 5. This methodological heterogeneity stems from the complexity of the research questions and the varying analytical objectives pursued by different scholars.

Quantitative methods dominate the reviewed literature, with gravity model variations representing the most frequently employed framework. These models often incorporate structural specifications that account for multilateral resistance terms owing to their strong theoretical foundation in trade theory and practical ability to estimate trade costs from readily available trade flow data. The econometric techniques demonstrate considerable sophistication, including panel data regression methods with fixed and random effects specifications, instrumental variable approaches to address endogeneity concerns, and difference-in-differences designs for examining policy interventions. Input-output analysis represents another significant methodological strand, particularly for measuring vertical specialization and value-added trade flows. Studies predominantly use the World Input-Output Database (WIOD) or the OECD Trade in Value Added (TiVA) database to calculate indicators such as vertical specialization indices and value-added content of exports [9], enabling researchers to trace cross-border flows of intermediate goods.

While quantitative methods dominate, approximately 15% of reviewed articles employ qualitative or mixed-method approaches, providing important complementary perspectives. Case study methodologies combine documentary analysis, stakeholder interviews, and institutional analysis to provide a rich contextual understanding of how trade costs affect firms' GVC participation. Comparative case study designs examine multiple countries or industries to identify patterns and variations, proving particularly valuable for understanding institutional and contextual factors that quantitative analyses may overlook.

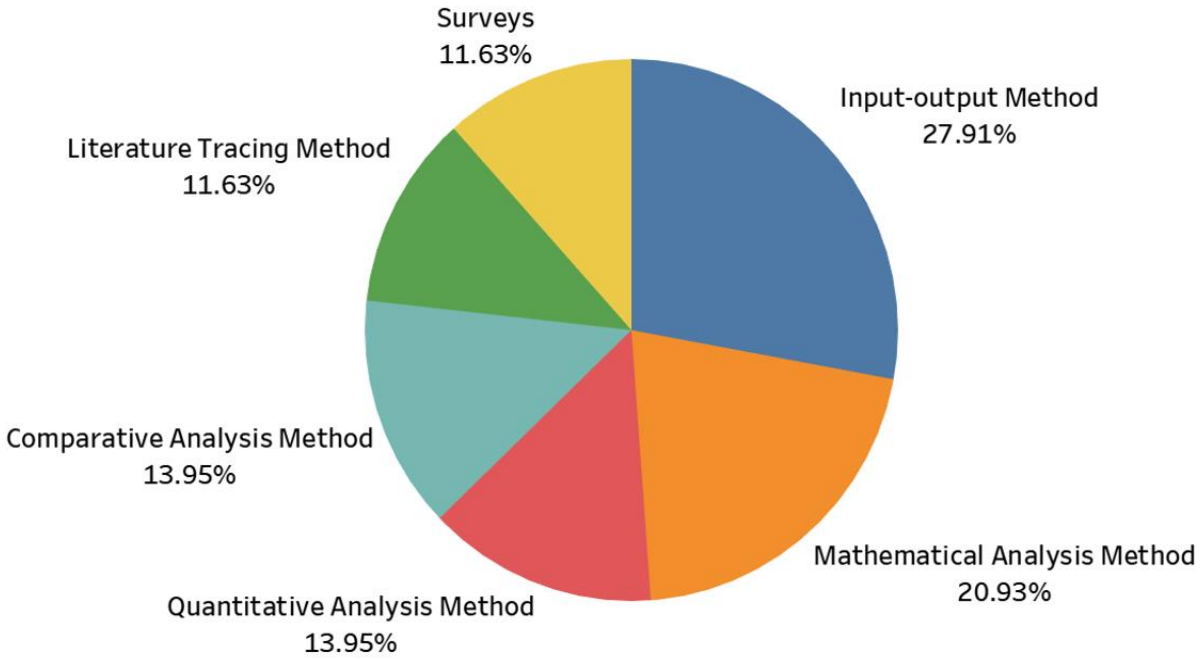

Figure 5.
Method distribution map of global value chain references addressing trade costs.

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Data sources exhibit considerable diversity, reflecting the multidimensional nature of trade costs. Trade flow data are derived from UN Comtrade, WTO statistical databases, and national customs agencies. Trade cost data come from multiple sources depending on the components analyzed, including WTO and UNCTAD databases for tariffs, shipping records, and c.i.f./f.o.b. price differentials for transportation costs, and World Bank indicators for time costs. Most quantitative studies employ panel data spanning at least ten years, with many focusing on periods surrounding key events such as China's 2001 WTO accession or the 2008-2009 financial crisis, while recent studies increasingly examine pandemic impacts.

Notably, the geographic scope concentrates heavily on China, with approximately 70% of articles including China in their analytical sample, reflecting both China's central importance in global manufacturing value chains and this review's focus. Manufacturing industries receive predominant attention, particularly electronics and electrical equipment, textiles and apparel, automotive, and machinery sectors. However, a notable research gap emerges regarding service sectors, which receive limited attention despite their growing importance in global production networks.

The operationalization of key constructs exhibits considerable variation across the literature. Specifically, trade costs are measured through diverse approaches, from gravity-model-based inference of aggregate bilateral costs to focused analysis of specific components such as tariffs, transportation costs, or time costs. An emerging literature strand measures trade costs in value-added terms [10], recognizing cumulative effects across production stages. GVC positioning employs various indicators, including vertical specialization indices, upstreamness measures, participation indices combining forward and backward linkages, and export sophistication metrics. Approximately 25% of studies employ multiple indicators to capture the multidimensional nature of GVC positioning, though this approach introduces challenges regarding potentially conflicting signals.

Beyond this, the reviewed literature reveals several persistent analytical challenges. Endogeneity concerns pervade much quantitative research, as trade costs and GVC positioning likely exhibit reciprocal causation. While some studies employ instrumental variable strategies, finding valid instruments proves challenging, and many findings should be interpreted as documenting associations rather than establishing causal effects. Moreover, data limitations constrain analyses of non-tariff measures and regulatory barriers, while aggregation of firm-level variation into industry observations may mask important dynamics. The static nature of most analyses limits understanding of dynamic adjustment processes, as GVC participation and upgrading involve inherently dynamic processes of capability development and learning that unfold over extended periods.

Despite these challenges, the methodological diversity reflects a maturing research field employing increasingly sophisticated analytical techniques. The combination of large-scale quantitative analyses and in-depth qualitative studies provides complementary perspectives that collectively advance understanding. However, important limitations persist. Gravity models typically generate aggregate bilateral trade cost measures that may mask firm-level and product-level heterogeneity, while input-output databases, though substantially improved, aggregate firm-level variation and have limited temporal coverage extending only to the early 2020s. These methodological and data constraints suggest important opportunities for innovation, as discussed in the future research directions.

3.6. Factors Influencing Global Value Chain Positioning

Based on a comprehensive analysis of the reviewed literature, this section combines the key factors identified as influencing countries' and industries' positioning within global value chains, with particular attention to how these factors interact with trade costs. The reviewed literature reveals that GVC positioning emerges from the complex interplay of policy choices, infrastructure capabilities, firm-level characteristics, industry-specific factors, and institutional environments.

Trade policy emerges as a fundamental determinant of both trade costs and GVC positioning. First, tariff levels directly affect the costs of importing intermediate inputs and exporting final products, with studies documenting that China's 2001 WTO accession and associated tariff reductions promoted

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deeper GVC integration. Second, beyond tariffs, non-tariff measures, including technical regulations and customs procedures, significantly influence trade costs, though streamlining these procedures can improve competitiveness. Third, free trade agreements serve as mechanisms for reducing trade costs and reshaping GVC participation patterns through tariff reductions, regulatory cooperation, and provisions addressing cross-border production sharing. Additionally, industrial policies also influence GVC positioning, with Chinese subsidies and technology development programs facilitating movement into higher value-added activities, though poorly designed policies may distort resource allocation.

Physical infrastructure quality critically determines trade costs and GVC participation capability. Notably, China's massive transportation infrastructure investments, including port facilities, road and rail networks, and air cargo capacity, substantially reduced domestic costs and improved global connectivity. Furthermore, information and communication technology infrastructure plays an increasingly important role, with improved connectivity reducing information costs and coordination challenges essential for fragmented production networks. Moreover, geographic location relative to major markets and production centers affects trade costs through multiple channels, with China's coastal location and proximity to East Asian economies facilitating integration into regional production networks, particularly during initial GVC integration phases when transportation costs represented larger shares of total trade costs.

At the firm level, multiple factors shape GVC participation patterns. Size significantly influences positioning, with larger firms possessing greater resources for overcoming fixed costs associated with international trade and achieving economies of scale in managing operations. Technological capabilities and absorptive capacity crucially affect firms' abilities to undertake higher value-added activities, with stronger capabilities enabling more complex production tasks and potential upgrading into design or research and development activities. Export experience generates learning effects, with accumulated knowledge reducing effective trade costs and enabling progression to more sophisticated value chain activities. Ownership structure matters for GVC positioning, with foreign-invested enterprises historically serving as crucial conduits that bring international market knowledge and production technologies, though indigenous Chinese firms increasingly participate independently as capabilities develop.

Industry characteristics substantially influence GVC participation patterns. Industries with high product modularity exhibit more fragmented production networks and extensive cross-border trade in components, exemplified by electronics manufacturing, where production can be separated across geographic locations. Scale economies shape GVC structures, with capital-intensive industries exhibiting less fragmentation while industries efficient at smaller scales show more dispersed networks. Product cycle characteristics influence the feasibility of GVC participation, with mature products offering more accessible entry points for developing country manufacturers. However, this dynamic highlights the importance of upgrading strategies for translating initial participation into sustained competitiveness in higher value-added activities.

The institutional environment significantly affects both trade costs and GVC participation capability. Effective legal systems, contract enforcement, and intellectual property protection reduce transaction costs and increase foreign firms' willingness to engage with domestic suppliers, with improvements in China's institutional environment facilitating foreign investment and improved domestic participation. Regulatory quality and administrative efficiency directly influence trade costs through border procedures and compliance burdens, with China's administrative reforms meaningfully reducing costs. Labor market institutions influence firms' flexibility and competitiveness in labor-intensive activities, with China's historically flexible markets facilitating rapid growth, though recent changes, including rising wages, are reshaping comparative advantages and inducing positioning adjustments. Environmental and social regulations increasingly influence participation patterns, with stringent regulations potentially excluding some firms while enabling compliant firms to access premium markets.

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In brief, the analysis reveals a complex, multidimensional landscape where policy choices, infrastructure investments, firm capabilities, industry characteristics, and institutional quality interact to shape positions within global production networks. Importantly, trade costs emerge not as exogenous parameters but as outcomes influenced by these factors, creating intricate feedback loops between trade cost reduction efforts and GVC positioning outcomes. This complexity emphasizes both the challenges facing policymakers seeking to improve GVC positioning and the importance of coordinated approaches addressing multiple dimensions simultaneously rather than focusing narrowly on any single factor.

3.7. Trade Costs and China's Manufacturing GVC Positioning: Synthesis of Findings

This section combines the reviewed literature's findings regarding the specific relationship between trade costs and China's manufacturing industry positioning within global value chains, directly addressing the study's third research question.

The reviewed literature provides substantial evidence that trade costs influence China's manufacturing GVC positioning, though effects vary across industries, time periods, and types of trade costs. Specifically, studies employing gravity model frameworks find that higher bilateral trade costs reduce trade volumes and particularly affect parts and components trade, characterizing fragmented production networks, directly constraining GVC participation extent and depth. Representative studies suggest that a 10% reduction in trade costs is associated with 15-25% increases in parts and components trade, with effects larger than those for final goods, which reflects the cumulative nature of trade costs where intermediate goods cross borders multiple times. Moreover, beyond participation extent, trade costs affect participation quality, with higher costs pushing firms toward activities requiring less frequent cross-border interaction, while reductions enable more complex, coordination-intensive activities.

The reviewed literature documents substantial sectoral heterogeneity reflecting differences in industries' technological characteristics, production organization, and trade cost sensitivity. Electronics and electrical equipment exhibit high sensitivity due to fragmented production structures and time-sensitive processes, with small trade cost reductions substantially enhancing participation depth. China's position as a central assembly hub reflects both absolute cost advantages and cumulative effects of infrastructure development, trade facilitation reforms, and regional agreements. In contrast, textiles and apparel exhibit different dynamics, with labor cost differentials often dominating location decisions, though trade costs affect the ability to serve distant markets and participate in fast-fashion chains. Rising domestic labor costs have induced the relocation of lower value-added stages while Chinese firms focus on higher value-added activities, including design and advanced production. Similarly, the automotive industry shows substantial regional concentration due to just-in-time requirements, with trade costs significantly influencing geographic organization, and suppliers typically located near assembly facilities. China's automotive participation evolved from labor-intensive components toward sophisticated parts and complete vehicle production, with bulky, lower-value components facing binding trade cost constraints that encourage local production. Machinery manufacturing encompasses diverse subsectors with varying sensitivities, with higher-value, lower-weight products trading more readily, while heavy equipment faces more binding constraints, thereby illustrating how product-level characteristics create substantial variation in trade cost sensitivity.

The reviewed literature reveals important temporal dynamics in the relationship between trade costs and China's GVC positioning. During the 1990s and early 2000s, manufacturing GVC integration accelerated dramatically, driven partly by declining trade costs from multilateral liberalization culminating in WTO accession and domestic reforms. Subsequently, since the mid-2000s, more complex dynamics emerged as rising domestic production costs altered competitive positioning in labor-intensive manufacturing, inducing adjustments with labor-intensive stages relocating while Chinese manufacturing focused on more capital- and skill-intensive activities. Notably, the 2008-2009 global financial crisis served as an inflection point, triggering renewed attention to resilience and accelerated

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upgrading efforts. More recently, rising trade tensions and the COVID-19 pandemic have highlighted trade cost considerations and vulnerabilities, with supply disruptions revealing how temporary spikes can severely disrupt fragmented networks, potentially inducing restructuring toward greater regional concentration.

Drawing on these findings, several policy implications emerge for enhancing China's manufacturing GVC positioning. Continued trade facilitation reforms, streamlining customs procedures, and reducing administrative burdens can meaningfully reduce costs, particularly for time-sensitive industries, with further improvements possible regarding regulatory transparency and interagency coordination. Sustained infrastructure investment in transportation and ICT continues to offer high returns, with addressing bottlenecks in inland regions and intermodal connectivity facilitating more geographically dispersed development. Strategic participation in regional trade agreements represents another important avenue, with deeper integration, including regulatory harmonization, addressing increasingly important non-tariff trade costs. Recognizing substantial sectoral heterogeneity suggests the value of differentiated policy approaches, with time-sensitive industries benefiting from logistics efficiency improvements while sectors facing high regulatory compliance costs benefit from harmonization efforts.

As rising domestic costs erode competitiveness in lower value-added activities, policy support for technological upgrading becomes increasingly important, though such support should enable rather than distort market-driven processes by addressing genuine market failures rather than predetermining industrial structure. The literature also highlights the importance of domestic value chain integration, whereby reducing internal logistics costs, regulatory barriers, and information asymmetries enhances competitiveness and enables more effective GVC participation, suggesting domestic and international market integration should be viewed as complementary.

In conclusion, the reviewed literature collectively demonstrates that trade costs significantly influence China's manufacturing GVC positioning through multiple channels, with effects varying across industries, firms, and time periods. The relationship proves complex and multifaceted, affecting not only participation extent but also the activity types and upgrading possibilities. Looking forward, continued trade cost reduction efforts, combined with policies supporting capability development and upgrading, can promote a transition toward higher value-added positions. However, this transition requires sustained attention to multiple policy dimensions simultaneously, recognizing that trade cost reduction alone proves insufficient without complementary efforts building technological capabilities, organizational competencies, and human capital underpinning sustainable competitive advantage. Finally, the temporal evolution demonstrates that success requires adapting strategies to changing circumstances, including rising domestic costs, evolving technological capabilities, and shifting global economic and political conditions.

3.8. Evolution of Research Hotspot Topics

To address the third research question regarding the impact of trade costs on China's manufacturing industry positioning within global value chains, this study analyzed 49 articles from the perspective of trade cost impacts, systematically examining the mechanisms through which trade costs influence GVC participation and positioning.

By arranging the most frequently appearing keywords chronologically, this analysis traces the evolution of research hotspots (as shown in Figure 6). Research focal points have undergone five distinct evolutionary phases: industrial policy, trade and investment models, enterprise capabilities and competitiveness, technology and innovation, and spatial dispersion and value-added production stages. These phases converge into three principal analytical dimensions capturing structural effects on enterprise export trade, transformational effects of technological innovation, and effects of foreign direct investment. Each dimension captures important channels through which trade cost variations influence firms' participation patterns, positioning strategies, and upgrading trajectories.

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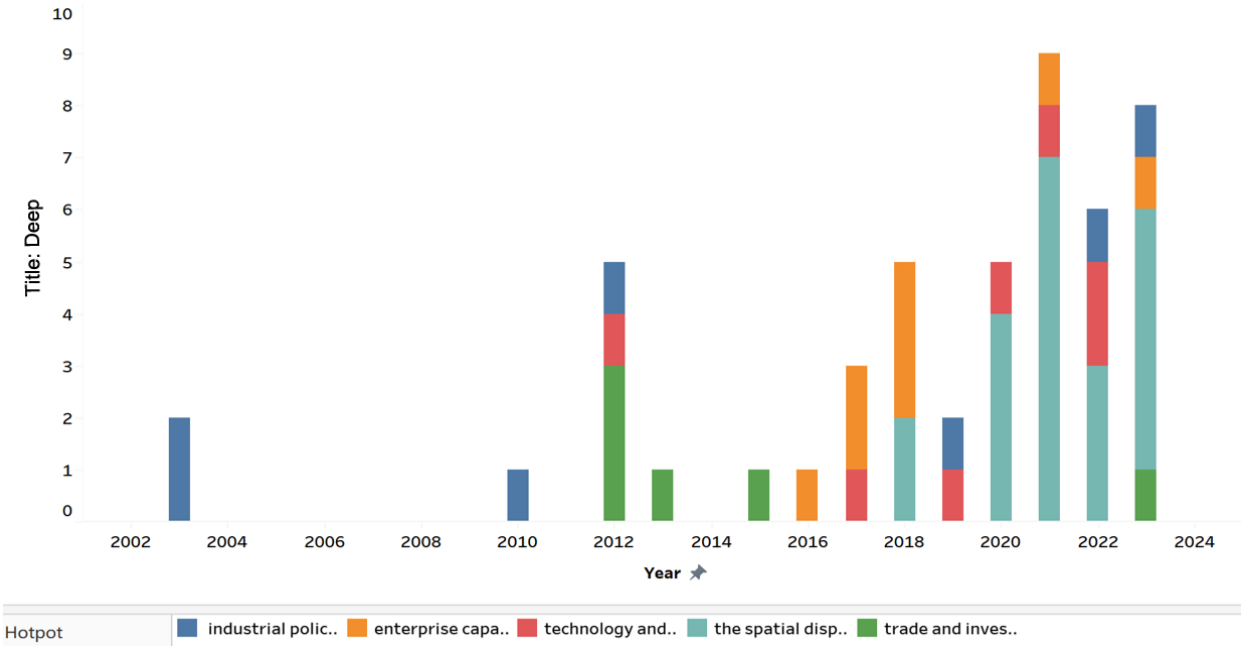

Figure 6.
Up bar graph of the evolution of hotspot topics related to the global value chain references.

The earliest research focuses on industrial policy, reflecting scholarly attention to how government interventions shape trade patterns and value chain participation, examining how tariff policies, export promotion programs, and sector-specific support measures affect trade costs. China's strategic industrial policies during the reform era, including export processing zones and preferential policies for foreign-invested enterprises, effectively reduced trade costs for participating firms and promoted rapid manufacturing export growth and GVC integration. Subsequently, the evolution toward examining trade and investment models reflects recognition that organizational choices, including processing trade arrangements, FDI structures, and contractual relationships with global buyers, fundamentally mediate how trade costs affect GVC participation. Processing trade, involving duty-free input imports for processing and re-export, substantially reduces effective trade costs and has historically constituted a dominant mode of GVC participation, enabling Chinese firms to participate in global value chains despite initially limited capabilities while facilitating subsequent capability development and upgrading.

Trade cost reductions through these structural arrangements have powerful multiplicative effects. By reducing input import costs, processing trade regimes enable firms to access higher-quality or more specialized inputs than are available domestically, enhancing product quality and competitiveness. Simultaneously, reduced export costs expand accessible markets, increasing production scale and enabling economies of scale. These interactions create positive feedback dynamics, accelerating GVC integration and industrial development, with firms benefiting from reduced input costs, producing more competitive products that justify further capability investments and scale expansion.

The evolution toward a focus on enterprise capabilities, competitiveness, technology, and innovation reflects a growing recognition that trade costs interact with firm-level capabilities in determining GVC positioning. While trade costs influence the feasibility and attractiveness of different value chain positions, firms' technological capabilities ultimately determine which positions they can effectively occupy. Trade cost reductions expand firms' access to foreign technologies, both embodied in imported capital goods and disembodied through increased interaction with foreign buyers and competitors, thereby improving learning and capability development that enable progression toward more sophisticated activities. Trade costs also affect returns to innovation and upgrading investments;

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reductions in trade costs expand market access and increase the returns to upgrading investments, potentially triggering increased innovation efforts. The literature provides evidence that Chinese manufacturers' upgrading trajectories have been substantially influenced by evolving trade cost conditions, with rapid reduction periods associated with accelerated technological catch-up. Furthermore, trade costs influence the organizational structures through which technological learning occurs within GVCs; higher costs increase the relative attractiveness of FDI and local production, bringing associated technology transfer and knowledge spillovers that have significantly contributed to Chinese manufacturing capability development.

Foreign direct investment constitutes a crucial mechanism, with trade costs and FDI exhibiting complex relationships as either substitutes or complements depending on FDI nature and industry characteristics. For market-seeking FDI, higher trade costs may incentivize foreign firms to establish local production facilities as substitutes for exports, with China attracting substantial market-seeking FDI as its domestic market has grown. For efficiency-seeking FDI, which aims to exploit factor cost advantages for production serving other markets, lower trade costs promote such investments that involve substantial trade in both inputs and outputs. China's manufacturing FDI boom during the 1990s and 2000s occurred contemporaneously with declining trade costs, fundamentally transforming China's manufacturing landscape and establishing the country as a central node in global production networks. FDI has served as a crucial channel for GVC integration and industrial upgrading, with foreign-invested enterprises bringing production technologies, management practices, quality standards, and connections to global buyer networks, while knowledge spillovers from foreign to domestic firms contributed to broader capability development.

The spatial dimension captures how trade costs interact with agglomeration economies and geographic considerations in shaping the spatial organization of value chains. Lower trade costs enable greater geographic fragmentation of production processes, though the costs that remain substantial relative to coordination costs and agglomeration benefits may favor more geographically concentrated structures. China's coastal regions, benefiting from both lower trade costs due to port access and supporting infrastructure and agglomeration economies from industrial clustering, have attracted disproportionate shares of export-oriented manufacturing and GVC participation, while interior regions face higher effective trade costs. However, recent infrastructure investments have partially improved these disadvantages.

The reviewed literature demonstrates that trade costs influence China's manufacturing GVC positioning through multiple, interconnected mechanisms operating through trade regimes and organizational arrangements, interactions between trade costs and technological learning, foreign investment decisions and associated technology transfers, and spatial organization determined by interactions with agglomeration economies. These mechanisms do not operate independently but interact in complex ways that increase individual effects and create emergent dynamics. For instance, processing trade regimes promote FDI inflows by reducing effective trade costs for foreign investors, while FDI brings technologies enabling movement into higher-value activities. Trade cost reductions expand markets, increasing returns to innovation investments while intensifying competitive pressures that compel upgrading. Understanding these interactions proves essential for formulating effective policies to improve China's GVC positioning through trade cost reduction and complementary interventions.

3.9. Directions for Future Research

This systematic literature review centers on two core conceptual elements: trade costs and global value chain division of labor positioning. Therefore, this article has primarily reviewed the general theory of trade costs, measurement methodologies for trade costs, the influences of trade costs, the concept of global value chains, global value chain division of labor structures, and the relationships between trade costs and GVC division of labor positioning.

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However, important challenges remain regarding these concepts. Clear, universally accepted definitions and scientifically confirmed measurement approaches for both trade costs and GVC positioning remain subjects of ongoing scholarly debate. Through careful examination of the 49 articles comprising this review's corpus, several areas emerge where prior research exhibits room for expansion or methodological improvement.

3.10. Geographic and Sectoral Scope

The literature exhibits substantial concentration on specific countries, industries, and time periods, raising questions regarding the generalizability of findings. China receives extensive attention, consistent with its central role in global manufacturing, but this concentration means that findings may reflect China-specific circumstances, including its combination of a large domestic market, initially low labor costs, strong state capacity, and strategic policies that may not characterize other countries seeking to improve GVC positioning through trade cost reduction.

Similarly, certain manufacturing industries, particularly electronics, textiles and apparel, and automotive, receive disproportionate research attention while others remain understudied. Service industries' roles in manufacturing value chains, despite their growing importance, receive limited attention. This sectoral concentration may limit understanding of how trade cost effects vary across industries with different technological characteristics, organizational structures, and governance patterns.

The concentration on specific geographic and sectoral contexts limits the generalizability of findings. Whether insights from China's experience apply to other developing and emerging economies remains uncertain. Similarly, findings from heavily studied manufacturing sectors may not transfer to other manufacturing industries or to service sectors increasingly incorporated into global value chains.

3.11. Temporal Coverage and Emerging Issues

Temporal concentration warrants significant consideration. Much influential research examines China's rapid GVC integration during the 1990s and 2000s, a period of particularly rapid trade liberalization and dramatic trade cost reductions. Whether insights from this exceptional period apply to contexts of more moderate trade cost change or to countries integrating into global value chains under different global economic conditions remains uncertain.

A persistent challenge confronting researchers concerns temporal data limitations. While input-output data necessary for measuring GVC participation and positioning have improved substantially with the development of databases such as WIOD and OECD TiVA, important limitations persist. Temporal coverage remains limited, with most multi-country input-output databases extending only to the early 2020s at the time of this review, limiting the ability to examine very recent developments, including pandemic-related disruptions and subsequent adjustments.

The inability to examine very recent developments, including the impacts of the COVID-19 pandemic, supply chain disruptions, geopolitical tensions, and the evolving digital economy on trade costs and GVC positioning, represents a critical gap. These emerging issues may fundamentally reshape the relationships between trade costs and GVC participation, yet remain largely outside the temporal scope of available data and existing research.

3.12. Methodological Innovations Needed

The literature exhibits a relatively concentrated use of methodological approaches, particularly gravity models for trade cost estimation and input-output analysis for GVC measurement. While these methods offer important advantages, including theoretical grounding, practical executability with available data, and comparability across studies, over-reliance on specific methodological frameworks may limit the range of questions addressed and insights generated.

The measurement methods for trade costs demonstrate concentration. While indirect estimation approaches based on gravity models dominate the literature, these methods typically generate aggregate

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measures of bilateral trade costs that may mask important heterogeneity across products, firms, and transaction types. More detailed analysis of specific trade cost components, examining, for example, how customs clearance time or regulatory compliance costs affect specific industries' GVC participation, could yield more actionable policy insights.

Comprehensive, consistently measured data on trade costs, particularly regarding non-tariff barriers, regulatory compliance costs, and various "behind-the-border" trade cost components, remain difficult to obtain across countries and time periods. This data limitation constrains empirical analysis and may contribute to the field's heavy reliance on indirect trade cost inference methods based on gravity model frameworks.

The index structures employed for measuring GVC positioning, while providing valuable summary measures, may oversimplify complex, multidimensional concepts. A country's or industry's position within global value chains encompasses multiple dimensions, including the extent of participation, the types of activities performed, the value captured, and the governance structures characterizing relationships with global lead firms. Single summary indices inevitably capture only some dimensions while potentially missing others. Future research might benefit from employing multiple complementary indicators to capture this multidimensionality more comprehensively.

While input-output databases have improved substantially, important limitations persist. These databases aggregate detailed firm-level heterogeneity into industry-level observations, potentially obscuring important within-industry variation in trade costs and GVC positioning. The development of methodologies that can better capture firm-level heterogeneity while maintaining cross-country comparability represents an important methodological frontier.

3.13. Needed Underexplored Topics

A particularly important finding concerns the asymmetric effects of trade costs on different types of goods. Several studies document that trade costs for intermediate goods and final goods affect China's manufacturing GVC positioning in opposite directions. Higher trade costs for intermediate goods discourage GVC participation by increasing costs of imported inputs necessary for fragmented production, while higher trade costs for final goods may encourage foreign firms to undertake local production, including through FDI, potentially benefiting domestic GVC participation through increased integration with foreign production networks. This asymmetry has important implications for research and policy but remains inadequately explored. The mechanisms generating these differential effects require further theoretical elaboration and empirical examination, particularly regarding how trade costs for different product categories interact with firm capabilities, industry characteristics, and policy environments.

Service industries' roles in manufacturing value chains receive limited attention despite their growing importance. As services become increasingly integral to manufacturing production processes and more tradable through digitalization, understanding how trade costs affect service industries' participation in global value chains (GVCs) represents a significant research gap. While the reviewed literature provides substantial evidence regarding trade costs' effects on GVC positioning, translating these findings into specific, actionable policy prescriptions remains challenging due to the complexity of trade costs, which encompass numerous distinct components requiring different interventions. Optimal policy approaches likely vary substantially across countries depending on current GVC positioning, industrial structure, institutional capacity, and development objectives. Policies appropriate for initial GVC integration differ considerably from those needed for upgrading within established value chains. Additionally, potential trade-offs and unintended consequences of trade cost reduction policies require more systematic attention, as regulations increasing compliance costs may serve important social or environmental objectives. It is crucial to understand how to achieve legitimate regulatory objectives while minimizing unnecessary trade cost burdens.

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3.14. Dynamic Analysis Requirements

While the reviewed literature provides substantial evidence that trade costs influence GVC positioning, the understanding of the precise mechanisms mediating these relationships remains incomplete. Most studies establish correlational relationships between trade cost measures and GVC positioning indicators, with causal identification receiving less attention. More rigorous causal analysis, potentially exploiting natural experiments created by trade policy changes or infrastructure improvements, could strengthen understanding of how trade costs affect GVC participation decisions and positioning outcomes.

Furthermore, the dynamic processes through which trade cost changes influence GVC participation and upgrading trajectories deserve deeper investigation. Most existing studies employ static or comparative static frameworks, examining relationships between trade cost levels and GVC positioning at points in time or changes between discrete time periods. However, GVC participation and upgrading involve dynamic processes of learning, capability accumulation, and relationship development that unfold over extended periods. Understanding these dynamic processes and how trade costs influence them requires analytical approaches explicitly incorporating temporal dynamics and adjustment processes.

Dynamic analysis could examine questions such as: How long does it take for trade cost reductions to translate into measurable changes in GVC positioning? What are the adjustment costs associated with repositioning within global value chains? How do firms' prior experiences and accumulated capabilities mediate their responses to trade cost changes? Addressing these questions requires longitudinal data and analytical frameworks that can capture evolution and adjustment over time.

Despite these limitations and gaps, the reviewed literature provides valuable insights into the relationships between trade costs and GVC positioning, particularly for China's manufacturing sector. The analysis presented in this review establishes a foundation for future research that can address identified gaps and extend understanding of these crucial relationships.

4. Conclusion

4.1. Summary of Findings

Through systematic examination of existing literature, this review outlines the importance of trade costs for China's positioning within the global value chain division of labor in manufacturing, while simultaneously tracing the evolution of research hotspots and identifying major research areas investigated by scholars from 1999 to 2023.

The comprehensive analysis of 49 carefully selected peer-reviewed articles reveals that research on trade costs and global value chains has undergone substantial evolution over the past two decades. Early research focused primarily on industrial policy and trade regime structures, subsequently broadening to encompass trade and investment patterns, enterprise capabilities and competitiveness, technological innovation, and, most recently, spatial dimensions of production and value-added considerations. This evolutionary trajectory reflects both the maturation of the research field and the changing realities of China's manufacturing sector as it has progressed from initial GVC integration toward increasingly sophisticated participation and upgrading aspirations.

According to the research results presented in this review, from an industry perspective, research on global value chain trade issues concentrates primarily within five domains: (1) industrial policy frameworks and their effects on trade cost structures and GVC participation patterns; (2) trade and investment modes, including processing trade arrangements, foreign direct investment patterns, and organizational forms mediating GVC participation; (3) enterprise capacity and competitiveness, encompassing both technological capabilities and absorptive capacity that enable firms to undertake higher-value activities within chains; (4) technology and innovation dynamics, including how technological learning occurs within GVCs and how innovation affects upgrading possibilities; and (5) spatial dispersion and value-added production stages, examining the geographic organization of production and the distribution of value-added across different locations and activities.

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4.2. Contributions to Existing Literature

Compared with existing literature, the potential research gaps identified by this systematic review are shown primarily in the following aspects: First, most existing literature has not systematically distinguished between intermediate goods trade costs and final goods trade costs in analyzing effects on China's manufacturing global value chain division of labor positioning. This distinction remains a significant gap in the literature. Subsequent research building on this review can further examine how different types of trade costs affect China's manufacturing industries at different technological levels and in relationships with different trading partners, investigating both the differential effects and their underlying mechanisms. Such analysis could provide a more detailed understanding of how trade cost reduction strategies should be adapted to specific industries and trading relationships.

Second, regarding trade cost measurement methodologies, existing literature provides limited differentiation by manufacturing industry technology level, trade partner type, and intermediate versus final goods distinctions. Future research extending this review can systematically categorize Chinese manufacturing data according to these dimensions, analyzing trade cost levels and elasticities across categories. Such analysis could identify manufacturing sectors exhibiting high dependence on foreign inputs or export markets, thereby providing policy recommendations for enhancing China's supply chain resilience and industrial chain security, issues that have gained salience considering recent supply disruptions and geopolitical tensions.

Third, while the literature provides substantial evidence that trade costs influence GVC positioning, a mechanistic understanding remains incomplete. This review consolidates existing knowledge regarding three principal mechanisms: structural effects through trade regimes and organizational arrangements, transformational effects through technological learning and innovation, and effects mediated through foreign direct investment. However, a more detailed investigation of how these mechanisms operate and interact represents an important avenue for future research.

Fourth, this review highlights the need for more dynamic analysis of how trade cost changes influence GVC participation and upgrading over time. Most existing research employs static or comparative static frameworks, potentially missing important insights regarding adjustment dynamics and path dependencies that characterize firms' and industries' GVC evolution.

4.3. Practical Implications

The consolidation of research findings yields several important policy implications. The consistent evidence that trade costs significantly affect GVC participation emphasizes the importance of continued trade facilitation efforts, including streamlining customs procedures, reducing administrative burdens, improving border efficiency, and enhancing regulatory transparency. For China, while substantial progress has been achieved, further improvements remain possible, particularly regarding interagency coordination and services trade facilitation. Sustained transportation and ICT infrastructure investments continue to offer substantial returns in reducing trade costs and enhancing GVC participation capability, with addressing remaining bottlenecks in inland regions and intermodal connectivity facilitating more geographically dispersed industrial development.

The substantial sectoral and firm-level heterogeneity documented in the literature suggests the value of differentiated policy approaches adapted to specific industry characteristics and firm capabilities, with time-sensitive industries benefiting particularly from logistics efficiency improvements while sectors facing high regulatory compliance costs benefit from regulatory harmonization efforts. As rising domestic costs erode competitiveness in lower value-added activities, policy support for capability development and technological upgrading becomes increasingly important, though such support should enable rather than distort market-driven upgrading processes by enhancing firms' absorptive capacity and learning capabilities. China's strategic participation in regional trade agreements can reduce trade costs with key partners and improve GVC integration, with deeper integration including regulatory harmonization and trade facilitation cooperation beyond tariff reduction yielding additional benefits.

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This systematic literature review, while providing a comprehensive synthesis of existing knowledge, exhibits several limitations, suggesting directions for future research. While the review appropriately focuses on China, a comparative analysis with other countries' experiences could provide valuable insights regarding the generalizability of findings and the contextual factors shaping trade cost effects. Future updates incorporating emerging research on pandemic-related disruptions, evolving trade tensions, and technological changes, including digitalization and automation, will be valuable, as these developments may fundamentally alter relationships between trade costs and GVC participation.

Future research could benefit from greater methodological diversity, including more firm-level empirical analysis, natural experiments exploiting policy changes for causal identification, and qualitative research providing rich contextual understanding of mechanisms. Several important topics warrant future investigation, including services trade costs and their effects on manufacturing competitiveness, environmental dimensions of trade costs and GVC participation, and labor market implications of changing trade costs and GVC structures. Future research explicitly modeling dynamic adjustment processes, including how firms learn through GVC participation, how capabilities accumulate over time, and how these processes interact with changing trade cost conditions, could substantially advance understanding, as most existing research employs static frameworks that may inadequately capture the evolutionary nature of GVC participation and upgrading.

4.4. Concluding Remarks

Trade costs play a crucial role in shaping countries' and firms' positioning within global value chains, with particularly important implications for China's manufacturing sector given its central role in global production networks. This systematic literature review consolidates existing knowledge regarding the relationships between trade costs and GVC positioning, identifying key mechanisms through which trade costs operate, documenting the evolution of research focus over time, and highlighting important gaps warranting future investigation.

The reviewed evidence consistently demonstrates that trade cost reductions, achieved through policy reforms, infrastructure improvements, and technological changes, have promoted China's dramatic manufacturing development and deep integration into global value chains over the past several decades. However, the literature also suggests that sustaining and enhancing China's manufacturing competitiveness increasingly requires not merely further trade cost reduction, though that remains valuable, but complementary investments in capability development, technological upgrading, and institutional strengthening that enable Chinese manufacturers to compete effectively in higher value-added activities.

Looking forward, several trends will likely reshape the relationships between trade costs and GVC positioning. Technological changes, including digitalization, automation, and additive manufacturing, may alter the economics of geographic dispersion and value chain organization. Evolving policy environments, comprising renewed attention to supply chain resilience, sustainability considerations, and shifting trade policy orientations, will influence both trade costs and the strategic considerations shaping GVC participation decisions. Understanding how these evolving factors interact with traditional trade cost determinants to shape future value chain structures represents an important challenge for research and policy alike.

This review contributes to the literature by providing a comprehensive synthesis of existing knowledge regarding trade costs and GVC positioning, with particular focus on China's manufacturing sector. The systematic approach employed, including rigorous literature screening, scientometric analysis, and thematic synthesis, enables the identification of research patterns, knowledge gaps, and opportunities for future investigation. These findings and frameworks can inform both future research, advancing theoretical and empirical understanding, and policy efforts aimed at enhancing manufacturing competitiveness through trade cost reduction and complementary interventions supporting industrial upgrading and sustainable development.

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Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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