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U.S. Tariff Policy and China's Export Structure Transformation: Mechanisms and Identification Strategies

Nan Cao

University of Toronto, Shanghai, 200023, China

ABSTRACT
Since 2018, the United States has imposed large-scale tariffs on Chinese exports, which have reshaped global trade patterns and caused widespread uncertainty. This paper reviews recent empirical literature on how Chinese exporters adjusted their product structures in response to these policy shocks. By summarizing current empirical strategies such as difference-in-differences (DID) and remote sensing, we not only evaluate the structural drivers, adjustment paths, and regional elasticity of China's export transformation, but also put forward structural adjustment policy recommendations from the enterprise and government levels.

KEYWORDS
Tariff policy; Export structure; Trade war; DID; Nighttime light; Structural adjustment; Global value chain (GVC)

1 Introduction

Since 2018, the U.S. government has imposed a series of high-intensity, wide-ranging tariffs on Chinese exports, signaling the beginning of a period of deep trade frictions between China and the United States. These tariffs cause a significant impact on the stability of the global trade system. According to the World Trade Organization (WTO, 2024), such high-tariff policies are expected to reduce global trade volume by nearly 3 percentage points in 2025 compared to a low-tariff scenario. As the main target of these tariffs, Chinese exporters have faced severe challenges, including compressed profit margins, increased volatility in orders, and rising compliance costs. These pressures have forced enterprises to reassess their product structures and market strategies. According to Trading Economics (2024), China's export composition is shifting from "low value-added final products" toward intermediate goods and high-end manufacturing. This transition may reflect both proactive industrial upgrading and passive adaptation to external shocks. However, The Economist (2024) points out that U.S. tariff barriers have structural "loopholes," with many Chinese firms circumventing tariffs by adjusting trade routes, altering product structures, or exporting through third countries. This highlights an ongoing dynamic game between policy interventions and firm-level strategic adjustments under the resilience of globalization.

To better understand these transformations, researchers increasingly use firm-level data and spatial analysis tools, employing methods like difference-in-differences (DID) combined with nighttime light data to identify causal effects and regional heterogeneity. This paper integrates these approaches to explore the core drivers and response mechanisms of China's export structural transformation, aiming to link micro-level behavior with regional patterns and measurement innovations, ultimately offering policy recommendations and directions for future research.

2 Drivers and dimensions of export structure adjustment

In response to escalating trade tensions and evolving global dynamics, scholars have analyzed Chinese export firms' structural adjustments across five major dimensions: policy uncertainty, market competition restructuring, GVC integration, spatial heterogeneity, and localized case responses. These areas reflect not only external constraints but also internal strategic adaptations by firms navigating an increasingly complex international environment. By systematically reviewing literature across these five domains, this paper seeks to clarify the drivers, pathways, and outcomes of structural transformation, providing a foundation for future policymaking and theoretical development.

2.1 Policy uncertainty and firms' behavioral adjustments

The instability of tariff policy increases the perceived risk in firms' decision-making processes. Given the institutional rigidity, persistence, and state-led nature of tariff measures, enterprises often struggle to respond promptly to changes, which in turn affects their medium- and long-term strategic planning. In this situation, firms tend to adopt more cautious export behaviors to minimize their exposure to uncontrollable future costs. This cautiousness is particularly evident in the shift from final consumer goods toward intermediate goods. Chen, Gao, and Wang (2021) highlight that policy uncertainty suppresses innovation investment and encourages firms to reallocate resources toward intermediate

products to buffer against market shocks. This is because intermediate goods tend to be less volatile in price, more resilient to market fluctuations, and more stable under high-tariff risk, making them an attractive choice for mitigating uncertainty.

This phenomenon is closely tied to the direct effects of tariff changes on product pricing. Amiti, Redding, and Weinstein (2019) found that the U.S.'s 25% tariff increased the retail price of Chinese products in the American market, but firms were unable to pass the full cost burden onto consumers. This mechanism forces firms to either compress profit margins or adjust their export portfolios to enhance resilience against policy shocks. Additionally, trade policy uncertainty indirectly influences firms' production and export decisions through financial channels. Gao and Wang (2024) observed that such uncertainty increases firms' borrowing costs—particularly for long-term and overseas financing—thereby constraining their capacity for expansion and innovation. As a result, firms tend to retreat to safer product lines and less risky markets. Collectively, these studies reveal the deep and multifaceted pathways through which policy uncertainty drives export structure transformation.

2.2 Market competition and the pathways of structural adjustment

Tariff measures have increased the entry costs of Chinese goods in international markets, reshaping global competition and driving firms to adjust their export strategies. Research by Yang, Liu, Dai, and Ni (2024) shows that after tariffs on final consumer goods were reduced, competition among firms intensified, creating dual pressure in terms of price and quality. In response, many adopted product differentiation strategies to avoid direct price competition, thereby protecting profit margins and improving adaptability. Boer and Rieth (2024) further argue that the rise of trade protectionism has not only compressed global trade volumes but also strengthened internal industrial filtering mechanisms. It pushes firms to target niche markets and develop high-value-added products to raise competitive barriers.

At the same time, trade frictions have triggered a redistribution of export market shares. Haberkorn et al. (2024) show that some small and medium-sized enterprises were able to achieve countercyclical growth by flexibly adjusting product lines and seizing market gaps in specific categories. This dynamic process of "exit–replacement–redistribution" reflects firms' proactive capacity for structural adaptation. Amiti et al. (2019) further notes that firms that fail to transform in time may face intense price competition or even market elimination. As such, firms respond to tariff shocks by optimizing their product portfolios and repositioning their export strategies. Overall, there exists a complex feedback loop between market competition and structural adjustment. While responding passively to external shocks, firms are also actively reconfiguring their export structures and supply chains, gradually building more resilient and adaptive export strategies.

2.3 Global value chain (GVC) embedding and export resilience

A firm's ability to adjust its structure in response to trade shocks largely depends on its level of embedding in the global value chain (GVC) and its position within it. The deeper a firm is embedded, the higher it is positioned along the value chain. They can quickly access external information, diversify risks, and flexibly restructure their production structures. Tian and Wang (2023) found that Chinese manufacturing firms located in higher value-added segments of the GVC typically possess strong independent capabilities and product diversification. These firms are better positioned to respond to trade frictions by adjusting export destinations, modifying product models, or shifting to intermediate goods, thereby avoiding tariff barriers more effectively. The depth of GVC embedding also determines a firm's bargaining power and its ability to hedge risks in the global division of labor. The liberalization of input trade reduces companies' procurement costs, enabling them to flexibly switch between multiple value chain nodes (Imbruno, 2022)

However, GVC embedding does not always lead to positive resilience. In some cases, firms begin to reduce dependence on overseas markets and global supply chains, opting instead to reinforce internal integration and self-sufficiency in intermediate goods (Du & Shi, 2024). This indicates that while GVC participation may enhance flexibility, it can also limit firms' strategic options. Furthermore, the evolution of global trade rules presents new challenges to the interaction between GVC positioning and structural adjustment. Boer and Rieth (2024) argue that protectionism has increased institutional friction in cross-border production, forcing firms to reassess their roles within global supply networks and to balance efficiency with security. In summary, while GVC embedding offers a pathway and resources for export restructuring, firms must navigate the trade-offs between openness and autonomy, especially in an increasingly uncertain global trade environment.

2.4 Spatial dimension and remote sensing identification

Regional differences cannot be ignored when studying export structure adjustments. In recent years, the advancement of remote sensing and spatial data technologies has made nighttime light data an effective tool for observing regional economic activity and structural changes. In the study of trade policy shocks, Chor and Li (2024) incorporated nighttime

light data into a DID framework and found that regions heavily affected by high tariffs experienced a significant decline in light intensity, indicating a weakening of export-oriented industrial vitality. A key advantage of this technology lies in its high spatial resolution and frequency, which enables identification of policy impacts across geographical dimensions. Furthermore, nighttime light data can reflect the micro-level mechanisms of export structure shifts. For instance, Yang et al. (2024), in a study on the effects of tariff reductions on consumer goods, noted that changes in city-level light intensity signaled spatial redistribution of export shares and revealed the regional foundations of structural adjustment.

However, remote sensing data still faces some challenges. For example, nighttime light However, remote sensing data still faces certain challenges. Nighttime light measurements are sensitive to natural factors such as weather and require careful correction to ensure accuracy (Donaldson & Storeygard, 2016). To improve reliability, scholars recommend cross-validating with geographic information systems (GIS) or other location-based data. When combined with DID models, remote sensing can help identify geographic response mechanisms during structural adjustment, offering valuable insights into how export firms restructure or relocate to mitigate external shocks (Gao & Wang, 2024). Overall, nighttime light data provides high spatial and temporal resolution, offering a valuable tool for analyzing corporate behavior.

2.5 structural resilience and localized case study: Yiwu

In the face of external trade shocks, Chinese exporters have demonstrated notable structural resilience, particularly in regional export hubs like Yiwu. Rather than falling into cycles of closure or withdrawal, many firms have pursued structural transformation, market diversification, and institutional adaptation. According to Yiwu Municipal Government (2025), the city's total import and export value exceeded RMB 660 billion in 2024, with exports to Belt and Road countries growing by over 20%, signaling the effectiveness of structural adjustment strategies.

Yiwu's export structure has shifted from low-end consumer goods to higher-value-added products such as intermediate goods and electronics. This transformation not only mitigates the impact of tariffs on final products but also helps redistribute supply chain risks. A key mechanism behind this shift is the widespread use of the "market procurement trade" model, characterized by small-batch, multi-category, and consolidated shipments. According to the General Administration of Customs (2024), this model enables SMEs to respond quickly to tariff changes by adjusting their export portfolios flexibly and cost-effectively. It not only reduces marginal customs clearance costs but also enhances the flexibility and responsiveness of structural adjustments.

At a theoretical level, structural resilience refers to a firm's ability to maintain survival and recover growth amid shocks. Factors such as industrial structure, supply elasticity, institutional environment, and market connectivity shape this resilience. As noted by Yang, Liu, Dai, and Ni (2024), firms with diverse product offerings and flexible supply capabilities are more likely to retain market share through micro-level structural adjustments. Yiwu exemplifies this: its highly diversified export portfolio and low dependence on any single product or market enable the region to withstand systemic disruptions more effectively.

3 Reasons and paths for structural adjustment

In the context of rising tariffs and increasing trade uncertainty, Chinese export firms are forced to reassess their product structures and market layouts in search of more stable development paths. Overall, export structure adjustments are driven by three main factors.

First, risk avoidance is the most immediate driver. Policy uncertainty encourages firms to reduce reliance on single markets or final consumer goods, shifting instead toward intermediate goods that are less affected by demand fluctuations and offer stronger bargaining power (Handley & Limao, 2017). Such products occupy upstream positions in the value chain, are less sensitive to end-consumer demand changes, and allow for greater market risk diversification. Moreover, as these products are typically traded between firms, their higher price elasticity makes it easier to distribute risks through contractual arrangements and supply chain planning.

Second, from a cost optimization perspective, structural adjustments also reflect firms' reassessment of resource allocation strategies. When profit margins for final products are squeezed, firms tend to focus on producing standardized, scalable intermediate goods to reduce unit costs while increasing value-added (Ren, Hao & Lin, 2024). Some export-oriented enterprises achieve this by narrowing product lines and concentrating on core competitive segments, thereby improving production efficiency, and strengthening supply chain integration.

Finally, repositioning within the global value chain has become the core path for medium- to long-term structural adjustments. Firms are shifting from low-end assembly toward higher value-added functions, either by enhancing design capabilities or by gaining control over intermediate goods segments to strengthen their bargaining power within the industrial chain. This adjustment process often evolves from passive responses to active transformation, ultimately reflecting a combination of micro-level risk management and macro-level self-adjustment mechanisms.

4 Integration of measurement tools for export structure analysis

Understanding the causal mechanisms of export restructuring requires precise identification tools and data support. In recent years, the combination of the difference-in-difference (DID) model and nighttime light data has become a key method in trade policy research.

The DID model identifies the net effect of policies by comparing changes between policy groups and control groups before and after policy implementation. It is particularly applicable when treatment groups are defined by inclusion on tariff lists. However, the method relies heavily on the "parallel trends" assumption, and if there are differences in trends between groups before the policy is implemented, the model results are prone to misinterpretation.

Nighttime light data serve as a proxy indicator for firm activity, industrial agglomeration, and structural change. Donaldson and Storeygard (2016) first systematically demonstrated its applicability as a GDP substitute. In the context of China's geographically concentrated export enterprises, this method is especially relevant for detecting changes in ports, industrial zones, and related areas. Nonetheless, resolution constraints and potential misinterpretation in urban–rural transition areas remain challenges.

Combining these two tools enables the detection of heterogeneous spatial effects of policy shocks. For example, spatial control groups across cities can be used to link changes in lighting intensity with export structure adjustments, revealing transformation pathways. When further integrated with GVC embedding indicators, this approach can map the causal chain of "embedding position—structural adjustment—spatial performance." Overall, this combined method provides a new analytical perspective for understanding structural evolution under policy shocks, though improvements in data processing and interpretive depth are still needed.

5 Policy recommendations and future research directions

Research indicates that under external shocks and institutional uncertainty, structural adjustment has become a crucial path for Chinese export firms to enhance resilience and maintain their international market share. Based on this, policy suggestions can be made from both the enterprise and government perspectives, along with directions for future research.

At the enterprise level, structural transformation should shift from a temporary response to a long-term strategy. On one hand, firms should enhance product value-added through technological upgrading, design improvement, and brand building, gradually shifting from final products to intermediate goods or integrated system solutions. On the other hand, they should optimize export market portfolios, reduce reliance on single markets, and strengthen channel stability. As Ren et al. (2024) note, improving the quality of intermediate goods not only helps sustain profit margins but also reinforces a firm's position within global value chains.

From the government perspective, it is advisable to accelerate the development of export support and transformation guidance mechanisms. Fiscal subsidies, tax incentives, and export rebates can be used to steer enterprises toward high-tech, intermediate, and green low-carbon products. Local governments can develop "export structural resilience zones" based on regional characteristics, reducing the costs of enterprise transformation through institutional innovation and platform support. At the same time, a national-level export structure database should be established, integrating firm-level, industrial chain, and global demand data to support policy evaluation.

Future research could focus on the time-lag effects of export structure transformation, exploring the tipping point at which firms shift from short-term coping to long-term strategic restructuring. It could also promote the integration of remote sensing data with customs statistics, developing more refined monitoring tools to capture regional heterogeneity in economic responses to policy shocks.

6 Conclusion

This paper focuses on the structural adjustment mechanisms of Chinese export enterprises in the context of China–U. S. trade frictions, systematically reviewing five research perspectives and identifying multiple influencing mechanisms—policy uncertainty, market competition, global value chain (GVC) embedding, spatial characteristics, and local institutional innovation—on the evolution of export structures. The findings show that, when facing external shocks, firms do not merely retreat passively; rather, they actively respond through intermediate goods substitution, market diversification, and structural upgrading, demonstrating a certain degree of structural resilience.

Moreover, the combined application of the difference-in-differences (DID) model and remote sensing data in empirical studies expands the boundaries for identifying policy impact effects and reveals the critical role of the spatial dimension in structural transformation. Future policies should support technological upgrading in enterprises while also addressing spatial heterogeneity and industrial matching efficiency in structural changes.

Ultimately, China's export structure transformation under trade frictions is not merely a short-term response but part of a deeper adaptive restructuring process. Strengthening the synergy between firm-level initiatives and government policies, while refining analytical tools to monitor structural changes, will be essential for building a more resilient and competitive export sector in the face of continued global uncertainty.

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