Postprint: Global Changes in China's Export Regional and Commodity Structure Dependencies, 2017-2022

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Date: 2025-02-27T00:00:00+00:00

Abstract

The "century pandemic" has in fact aligned with the US-Western strategic intention of using "value chain decoupling" to hinder the strengthening of China' s economic power and maintain their own hegemonic status, objectively exerting tremendous pressure on China' s exports. To address the shortcomings of existing research, this study selects inter-provincial-country/region export data with commodity codes from 2017–2022, and employs geographic concentration, export market diversification index, export decomposition specialization location entropy, and other methods to analyze the global changes in China' s export dependency from 2017–2022. The results indicate that: (1) The spread of Western geopolitical competition logic into the economic domain has indeed accelerated the global changes in China' s export dependency in recent years. China' s exports to traditional developed economies exhibit a "high yet unstable" pattern; however, China' s core export origins still demonstrate high dependence on these economies, which remain China' s most important export markets. (2) The concentration degree of exports across the four major commodity categories basically conforms to the pattern of "resources > technology > labor > capital" , while the overall degree of unbalanced export specialization presents a pattern of "resources > labor > technology > capital" . The contributions of export extensive margin from emerging market countries such as Southeast Asia and export intensive margin from European countries have driven relatively significant market diversification in technology-intensive exports. Although the distribution of export destinations for the four major commodity categories is becoming more balanced over time, it is evident that exports from most western provinces are more dependent on a few destinations and resource-intensive goods, posing greater dependency risks. Export channel construction, industrial structure upgrading, and technology linkage development are crucial for western regions to reduce export risks and reconstruct the export competition landscape.

Full Text

Introduction

Foreign trade has long underpinned China' s rapid ascent in the global economic network and significantly transformed its industrial landscape. However, given that fewer than 5% of Chinese cities account for over 80% of national export volume, and regions with high export dependence typically exhibit deeper reliance on a handful of developed economies, dependency risks are substantially exacerbated. This concentration implies that these regions will suffer more severe market volatility during global downturns. China' s high-intensity exports to the West also signify international trade imbalances, triggering dissatisfaction in Western countries—particularly the United States—which attempts to maintain its economic hegemony through various economic and non-economic means. The ongoing China-U.S. trade friction, compounded by the COVID-19 pandemic, has accelerated the shortening, regional clustering, and nearshoring reshaping of global value chains. This development objectively aligns with the U.S.-Western strategy of further "decoupling" to restrict China' s rapid rise and maintain their absolute leading position, thereby posing significant challenges to China' s exports.

In summary, China' s export dependence carries substantial risks at both geographic and commodity structure levels. Under multiple uncertainties such as China-U.S. trade friction and the COVID-19 pandemic, the global economy exhibits simultaneous complexity and de-globalization, significantly increasing foreign trade vulnerability and negatively impacting economic growth and social development. Although existing literature has demonstrated China' s export dependence through econometric methods and explained it through political economy, economic geography, and international trade theories, these studies typically rely on national trade data or aggregate export statistics, neglecting significant regional heterogeneity within China and rarely analyzing both geographic and commodity structure dependence simultaneously. Consequently, they cannot comprehensively evaluate export dependence risks.

This study addresses these gaps by analyzing inter-provincial and international export data with HS 2-digit commodity codes from 2017 to 2022. Employing geographic concentration, export market diversification index, and export decomposition specialization location entropy methods, we examine global changes in China' s geographic and commodity structure export dependence to provide scientific references for future optimization directions.

Data Sources

Core data were obtained from the China Customs Trade Database, UN Comtrade Database, and *Trade and External Economic Statistical Yearbook* (Table 1). Following Chen Wanling et al. [22], we reorganized commodity categories from HS 2-digit codes into four types: resource-intensive, labor-intensive, capital-intensive, and technology-intensive. Export destinations were grouped

into major regions: Western Europe, Eastern Europe (including the three South Caucasus countries), North America, Latin America, Africa, Middle East, Central Asia (including Afghanistan), South Asia, Southeast Asia, East Asia, and Oceania. National and regional export data were aggregated to these major regions.

Note: HS 2-digit codes for resource-intensive commodities: 28, 29, 31-40, 72-84, 86, 87, 89; for technology-intensive: 30, 85, 88, 90-93. Service commodities are excluded.

Geographic Concentration

Geographic concentration is a crucial indicator for measuring spatial distribution uniformity [29]. We use it to measure the distribution and changing trends of China' s export flows. The formula is:

$$G_m = \sum_{i=1}^{n} \left(\frac{X_{mi}}{X_m} \right)^2$$

where G_m is the geographic concentration of category m commodity exports for the nation or province; X_{mi} is the export value of category m to destination i; X_m is the total export value of category m; and n is the number of export destinations. G ranges between 0 and 1, with larger values indicating stronger geographic concentration.

Export Market Diversification Index

Drawing on Jiang Cheng et al. [27] and Frenken et al.' s regional industrial market diversification indicators, we construct an export market diversification index:

$$V_m = \sum_{i=1}^{n} S_{mi} \ln \left(\frac{1}{S_{mi}} \right)$$

where V_m is the market diversification index for category m commodity exports, and S_{mi} is the share of category m exports to destination i. Larger V_m values indicate higher market diversification.

Export Decomposition Specialization Location Entropy

Location entropy typically measures regional industrial specialization [28]. We construct export decomposition specialization location entropy to measure export non-equilibrium specialization and identify provincial dependence on specific destinations for particular commodities:

$$LQ_{rm} = \frac{e_{rm}/e_r}{e_{Nm}/e_N}$$

where LQ_{rm} is the decomposition specialization location entropy of province r' s commodity m exports; e_{rm} is the export value of commodity m to destination r; e_r is the total export value of all four commodities to destination r for that province; e_{Nm} is the export value of commodity m to all destinations; and e_N is the total export value of all four commodities to all destinations for that province.

Results and Analysis

National Export Dependence Changes

Overall, East Asia, North America, and Western Europe represent the destinations of strongest Chinese export dependence. Correspondingly, export shares to Europe, Southeast Asia, and Latin America have increased rapidly, indicating strengthening dependence on these regions. Dependence on other regions shows low-level fluctuations with minimal overall change, primarily due to these regions' smaller economic scales and underdeveloped market demand.

Despite the pandemic' s impact and China-U.S. trade friction posing enormous threats to China' s high-tech industries, China has established a core position in technology-intensive commodity trade networks and developed difficult-to-substitute competitive advantages in fields such as communications technology. Consequently, except for the 2019 decline in exports to the United States and significant drops to the United Kingdom and Mexico in 2020, overall exports have maintained relatively strong growth.

The four major export commodities exhibit significant spatial differences in regional dependence. **Resource-intensive exports** show the highest shares to East Asia and Southeast Asia, but with continuous decline to the former and fluctuating growth to the latter; shares to Western Europe have increased overall; the North American share was nearly halved in 2019 and has since lagged behind Western Europe. **Labor-intensive exports** show continuous decline in dependence on Europe, North America, and East Asia, but strong growth to Southeast Asia—exceeding East Asia since 2020 and approaching Western Europe, accounting for over 15% of total exports. **Capital-intensive exports** show overall decline to North America, East Asia, South Asia, and the Middle East, but rising shares to Europe and fluctuating growth to Latin America, Africa, Oceania, Southeast Asia, and Central Asia. **Technology-intensive exports** show strongest but rapidly declining dependence on East Asia; overall decline to North America with a slight 2022 rebound; rising shares to Europe, Southeast Asia, and Latin America; low-level fluctuations to Africa, the Middle East, Central Asia, and Oceania; and a complete "V-shaped" trend to South Asia.

Provincial Export Connection Changes

Using 1000$\times 10\hat{}\{8\}$ yuan as the threshold for destination countries, we find that compared with 2017, the 2022 list excludes Iran but adds Egypt, Nigeria, Czech Republic, Israel, Kazakhstan, Kyrgyzstan, Colombia, and Chile (Figure 2). Export shares to Central Asia, South Asia, and Latin America reached their nadir in 2020 before rebounding in a "V-shaped" recovery.

Both origins and destinations of China' s four major industrial exports display highly concentrated distribution patterns. China Hong Kong, the United States, Japan and South Korea, and European countries constitute the most important export destinations, with higher export values showing greater concentration in China Hong Kong and the United States—demonstrating clear high-concentration characteristics globally.

Guangdong serves as the common core export origin for all four industries, while Beijing-Shandong, Zhejiang-Jiangsu-Shandong, Zhejiang-Jiangsu-Shanghai-Shandong, and Jiangsu function as secondary cores for resource-intensive, labor-intensive, capital-intensive, and technology-intensive exports respectively. Examining the strongest linkages reveals an overall fluctuating upward trend (Table 2), though some commodities experienced significant declines in 2020 —most notably resource-intensive exports, which showed sustained recovery thereafter. Labor-intensive exports exhibit considerable volatility for most destination countries.

Evolution of Provincial Export Destination Geographic Concentration

The geographic concentration of the four commodity exports follows the pattern "resources > technology > labor > capital" (Figure 4). Capital-intensive exports—including mechanical equipment, steel products, plastics, and organic chemicals—have long been pillars of China' s export trade. In particular, engineering machinery and general electromechanical industries represented by Sany Heavy Industry, XCMG, Chery Automobile, and BYD Group have leveraged specialized capabilities and cost advantages to capture booming infrastructure demand and consumer markets in emerging developing countries, continuously expanding exports across Asia, Africa, and Latin America while maintaining the highest market diversification.

In contrast, while labor-intensive exports benefit from accumulated experience and market competitiveness, they face easier imitation and wage-level constraints that compress profit margins and limit market expansion. Resource-intensive and technology-intensive exports primarily flow to developed countries and Southeast Asia, showing less attraction to underdeveloped Asian regions, Africa, and Latin America.

Geographic concentration analysis reveals that except for Guangdong' s relatively high concentration in resource-intensive exports, other high-concentration

provinces are concentrated in central and western regions—particularly Guizhou, Guangxi, and Tibet—while lower-concentration provinces are mostly industrially developed central and eastern regions. However, resource-intensive exports predominantly originate from western provinces, reflecting substantial comparative advantage differences among domestic regions. Due to insufficient marketization and globalization, some western provinces' exports may be highly dependent on few destinations, posing greater dependency risks. Nevertheless, temporal analysis shows the scatter distribution of the four industries' exports continuously shifting toward the second quadrant, indicating provincial-scale destination distribution is becoming more balanced.

Provincial Export Non-Equilibrium Specialization Changes

Provincial export non-equilibrium specialization exhibits an overall "resources > labor > technology > capital" pattern, with resource and labor-intensive exports showing rising trends while capital and technology-intensive exports show the opposite (Figure 5). **Resource-intensive exports**: Tibet' s non-equilibrium specialization degree is significantly higher than other provinces due to exporting only to a few developed economies like Japan and South Korea. Qinghai, Shaanxi, Xinjiang, and Shanxi show strong dependence on Southeast Asian countries, China Hong Kong, and South Africa. The Sichuan-Chongqing region shows strong dependence on Spain, while Zhejiang depends heavily on China Hong Kong and Singapore.

Labor-intensive exports: Shanxi shows particularly high dependence on Bangladesh and Kyrgyzstan, while Qinghai and Shaanxi depend mainly on European countries (Italy, UK, Poland) and Middle Eastern countries (Saudi Arabia). Since Hainan' s export globalization relies primarily on resource-intensive industries, its dependence on multiple global countries/regions is relatively high. Additionally, Tibet' s non-equilibrium specialization degree increased significantly in 2022, with exports highly concentrated in the United Kingdom, United Arab Emirates, and India.

Capital-intensive exports: Overall levels remain low. In 2017, the Qinghai-Tibet region showed relatively high values, with Tibet highly dependent on China' s Taiwan and the Philippines, and Qinghai on India, Bangladesh, Turkey, Mexico, etc. **Technology-intensive exports**: Most provinces show declining non-equilibrium specialization degrees, with export directions becoming more balanced. Provinces with higher degrees are mainly Qinghai, Ningxia, Xinjiang, and Hainan, all showing stronger dependence on developed economies.

Discussion

For a long time, developed economies such as Europe, America, Japan, South Korea, and China Hong Kong have almost monopolized Chinese export destinations [30]. Although some studies indicate China has undergone long-term export geographic structure transformation, with endogenous factors driving a

shift from developed-country focus to balanced developed-developing country markets, and that "decoupling theory" does not fully explain declining export competitiveness to the West [31], U.S.-triggered value chain decoupling over trade deficit concerns [32] has accelerated the spread of Western geopolitical competition logic in economic spheres, forcing accelerated changes in China's global export dependence.

Nevertheless, both origins and destinations of the four major commodity exports show highly concentrated distribution patterns dominated by the strongest linkages. Coastal provinces (Guangdong, Jiangsu, Zhejiang, Shandong) serve as core export origins, all showing high dependence on traditional developed markets (United States, China Hong Kong) that remain China's most important export markets.

The geographic concentration pattern "resources > technology > labor > capital" and specialization pattern "resources > labor > technology > capital" reveal that although technology-intensive export geographic concentration remains high, emerging markets—particularly Southeast Asian and European countries—have provided remarkable contributions to export expansion and intensive margins, driving further market diversification. Over time, export destinations are becoming more balanced, yet most western provinces remain heavily dependent on few destinations and resource-intensive commodities, posing greater risks. Developing export corridors, upgrading industrial structures, and fostering technological linkages are crucial for western regions to mitigate export risks and restructure competitive patterns.

This study has limitations. First, export dependence on major destinations is based on simple aggregate and commodity-type classifications. In reality, varying trade bases, commodity substitutability and monopolistic characteristics, and potential export disruptions from changing political-economic relations mean dependence and risk are not completely linear. Second, outward foreign direct investment, domestic production, and domestic demand changes are closely related to export dependence. The weakening of traditional trade growth mechanisms makes finding new development drivers urgent, but space limitations prevent analysis of export relationships with outward investment and domestic market integration—crucial for China's "dual circulation" strategy. Additionally, due to lagged pandemic and trade friction effects, China's export trade will remain uncertain in coming years, requiring further in-depth mechanism research and more detailed investigation of specific origins, destinations, and commodity types.

Conclusion

(1) East Asia, North America, and Western Europe are the three regions with strongest Chinese export trade dependence, but they have shown significant fluctuations, presenting a "high but unstable" state. In contrast, dependence on Southeast Asia, Latin America, and Eastern Europe

has significantly strengthened. Beyond endogenous drivers such as factor structure adjustment, industrial upgrading, and changes in comparative advantages, the spread of Western geopolitical competition logic in economic spheres has accelerated changes in China' s global export dependence.

(2) The geographic concentration of four major commodity exports follows the pattern "resources > technology > labor > capital," while export non-equilibrium specialization shows "resources > labor > technology > capital." Although technology-intensive export geographic concentration remains high, emerging market countries—particularly in Southeast Asia and Europe—have provided higher contributions to export expansion and intensive margins, driving technology-intensive exports toward greater market diversification. Over time, export destination distribution is becoming more balanced, yet most western provinces remain heavily dependent on few destinations and resource-intensive commodities, posing greater risks. Developing export corridors, upgrading industrial structures, and fostering technological linkages are crucial for western regions to reduce export risks and restructure competitive export patterns.

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Note: Figure translations are in progress. See original paper for figures.