

MINISTRY OF SCIENCE AND HIGHER EDUCATION
OF THE RUSSIAN FEDERATION

Federal State Budgetary Educational Institution of Higher Education

PENZA STATE UNIVERSITY

Institute of Economics and
Administration
Field of study
Master's degree programme

Department of Sociology, Economic
Theory and International Processes
38.04.01 Economics
International Economics and Business

GRADUATION THESIS

on

Comparative analysis of the foreign trade of Russia and China

Master's degree student

signature, date

Wang Chen

Academic adviser

signature, date

Vlazneva S. A.

Compliance supervisor

signature, date

Vlazneva S. A.

Reviewer

Head of the Department
of Economics and Finance of Penza Branch of
Federal State Educational Budgetary
Institution of Higher Education
Financial University under the Government of
the Russian Federation

signature, date

Barbashova S. A.

The thesis was approved for defence (record of the department meeting dated _____ no.____)

Head of the Department

signature, date

Rozhkova L.V.

The thesis was defended and marked _____ (record of the State Examination Board dated
_____ no.____)

Secretary of the SEB

signature, date

Rasskazova N. V.

Penza 2026

FSBEI HE Penza State University
Institute of Economics and Administration
Department of Sociology, Economic Theory and International Processes
Field of study 38.04.01 Economics,
Master's degree programme International Economics and Business

APPROVED BY:
Head of the Department
Doctor of Social Sciences,
Professor
Rozhkova L.V.

« _____ » _____ 20 ____

ASSIGNMENT
FOR THE GRADUATION THESIS OF

Master's degree student Wang Chen, group 24ЭЭВам1, full-time mode of study

1 The topic of the graduation thesis: "Comparative analysis of the foreign trade of Russia and China"

was approved by the university order

dated « ____ » _____ 20 ____ no. _____

2 The deadline for the Master's degree student to complete the graduation thesis is 15.06.2026.

3 The input data for the graduation thesis is the regulatory and legal framework, scientific literature and reference books, and Internet data.

4 The list of issues to be studied includes evolution of bilateral trade flows; sectoral decomposition: energy, machinery, agriculture; revealed comparative advantage analysis; sectoral case studies: complementarity, dynamics and structural asymmetries in Russia-China trade; the dual structure of Russia-China complementarity; reconfiguration of bilateral economic cooperation.

5 The list of visuals contains tables and figures.

6 The date of setting the assignment is 8.10.2024.

Academic adviser _____ / Vlazneva S. A. /
(signature) (full name)

The assignment was accepted by Master's degree student _____ / Wang Chen /
(signature) (full name)

Schedule for completing the graduation thesis

№ п/п	Content of the thesis	Deadline for completion	Due date, signature of the academic adviser
First year of study			
1	Substantiating of the research topic and methodology, subject and object of research	1.09.2024 – 31.10.2024	
2	Framing the scientific concept of research	1.11.2024 – 18.12.2024	
3	Collection of scientific literature for the thesis	19.12.2024 – 15.01.2025	
4	Substantiating the relevance, concept, and novelty of the research	16.01.2025 – 19.02.2025	
5	Framing of a detailed plan and layout of the research	20.02.2025 – 12.03.2025	
6	Studying new literature sources within the topic of the thesis	13.03.2025 – 26.03.2025	
7	Conducting theoretical research within the first chapter of the thesis	27.03.2025 – 30.04.2025	
8	Preparing the first chapter of the thesis	1.05.2025 – 30.06.2025	
Second year of study			
9	Conducting analytical research within the second chapter of the thesis	1.09.2025 – 22.10.2025	
10	Preparing the second chapter of the thesis	23.10.2025 – 24.12.2025	
11	Conducting analytical research within the third chapter of the thesis	25.12.2025 – 25.02.2026	
12	Preparing the third chapter of the thesis	26.02.2026 – 21.04.2026	
13	Preparing the introduction and conclusion	22.04.2026 – 12.05.2026	
14	Completing the graduation thesis	13.05.2026 – 27.05.2026	
15	Handing in the thesis for compliance control and antiplagiat	28.05.2026 – 11.06.2026	
16	Getting acquainted with the feedback and review	13.06.2026	
17	Presenting the written thesis	15.06.2026	

Academic adviser _____ / Vlazneva S. A. /
(signature) (full name)

The assignment was accepted by Master's degree student _____ / Wang Chen /
(signature) (full name)

Summary

The graduation thesis comprises 71 pages, 3 chapters, 7 figures, 8 tables, 69 sources. RUSSIA, CHINA, TRADE COOPERATION, EXPORT, IMPORT, TRADE STRUCTURE, TRADE COMPLEMENTARITY

The object of this research is international bilateral economic relations. The subject of this thesis is current state, problems and prospects of China and Russia trade relation.

The master thesis aims to carry out a comprehensive analysis of the structure, evolution, and specialisation patterns of foreign trade between Russia and China.

The methodological framework of the paper is formed by system approach, analysis and synthesis, statistical and comparative methods. To display identified economic dependencies graphical method was applied.

The results of research include: evolution of bilateral trade flows was studied; sectoral decomposition: energy, machinery, agriculture were examined; revealed comparative advantage analysis was conducted; complementarity, dynamics and structural asymmetries in Russia-China trade were identified; the dual structure of Russia-China complementarity was studied; reconfiguration of bilateral economic cooperation was identified.

The novelty of the work consists in identifying the main trends and structural shifts in Russia-China trade, assessing the prospects for further development of bilateral cooperation, and putting forward suggestions aimed at improving the trade structure and reducing its current asymmetries.

The study extends international trade theory by demonstrating that abrupt shifts in the external trade environment, not just factor endowments, can deepen vertical specialisation.

The practical significance of the study lies in highlighting for Russia the risks of over-reliance on primary exports and the need for industrial diversification, for China the importance of balancing market expansion with regulatory complexity, and for other asymmetric bilateral relationships a framework for assessing trade realignment. The novelty of work is trends, prospects for the development of trade cooperation of the countries and suggestions on optimization of trade structure are revealed.

Content

Introduction.....	3
Chapter 1 Empirical dimensions of Russia-China trade: trends, structure and revealed comparative advantage	6
1.1 Evolution of bilateral trade flows.....	6
1.2 Sectoral decomposition: energy, machinery, agriculture.....	22
1.3 Revealed comparative advantage analysis.....	30
Chapter 2 Sectoral case studies: complementarity, dynamics and structural asymmetries in Russia-China trade.....	38
2.1 Energy sector: complementarity and trade patterns.....	38
2.2 Agricultural trade dynamics.....	42
2.3 Manufacturing sector	46
Chapter 3 Results and discussions: the asymmetry of complementarity and reorientation of trade flows	52
3.1 The dual structure of Russia-China complementarity.....	52
3.2 Reconfiguration of bilateral economic cooperation.....	57
Conclusion.....	63
References.....	66

Introduction

Trade and economic relations between Russia and China have emerged as a central axis of the Eurasian and global trading system in recent years. The large-scale redistribution of international merchandise flows, the reshaping of established transport and logistics corridors, and the overhaul of currency and financial settlement mechanisms have elevated bilateral trade to an unprecedented level of importance for both countries. This dynamic growth in turnover has been accompanied, however, by an intensifying structural asymmetry: Russian exports are overwhelmingly concentrated in a narrow range of primary commodities, whereas Chinese deliveries are highly diversified and carry a pronounced industrial profile. While such a model generates short-term gains, it simultaneously produces a set of long-term risks linked to technological lag, price dependency, and diminishing flexibility in foreign economic positioning.

The scholarly relevance of the topic is determined by several considerations. First, traditional theoretical models of international trade do not fully account for the rapid deepening of vertical specialisation between two large economies under conditions where standard assumptions – an open competitive environment and institutional stability – are subject to severe tests. Second, existing empirical studies rarely combine macro-level analysis of aggregate flows with detailed sectoral case studies (energy, agriculture, machinery) and the assessment of revealed comparative advantage, thereby limiting understanding of the real drivers and barriers of bilateral cooperation. Third, the swift reconfiguration of economic ties creates a pressing need for analytical tools that allow the separation of trade-diversion and trade-creation effects and an evaluation of the long-run sustainability of the emerging model of interaction.

The study gains particular significance from its chosen focus on the dual nature of complementarity – the simultaneous coexistence of deep vertical linkages and extremely limited horizontal cooperative ties in high-technology sectors. As the research demonstrates, it is precisely this combination that generates a dependence trap, which requires careful examination from the perspective of both the Russian and the Chinese side. Addressing the comparative analysis of foreign trade between Russia and China is

therefore timely in both theoretical-methodological and practical-applied terms, creating a foundation for the formulation of adaptive strategies in a rapidly changing international economic environment.

The object of this research is international bilateral economic relations. The subject of this thesis is current state, problems and prospects of China and Russia trade relation.

This master thesis aims to carry out a comprehensive analysis of the structure, evolution, and specialisation patterns of foreign trade between Russia and China. In order to achieve this goal we need to complete the following tasks:

- to trace the evolution of Russia–China trade flows and establish the main macro-level trends and phases;
- to decompose bilateral trade by major sectors – energy, machinery, and agriculture – and reveal their relative weight and dynamics;
- to compute and interpret indices of revealed comparative advantage (RCA) for key product groups, identifying areas of specialisation and competitive weakness;
- to conduct focused sectoral case studies (energy, agriculture, manufacturing) in order to uncover structural asymmetries, patterns of complementarity, and the practical obstacles to deeper cooperation;
- to synthesise the dual structure of complementarity and evaluate how the reconfiguration of economic relations is reshaping bilateral trade flows.

The novelty of the work consists in identifying the main trends and structural shifts in Russia-China trade, assessing the prospects for further development of bilateral cooperation, and putting forward suggestions aimed at improving the trade structure and reducing its current asymmetries.

The study extends international trade theory by demonstrating that abrupt shifts in the external trade environment, not just factor endowments, can deepen vertical specialisation. The concepts of externally driven vertical deepening and the dependence trap offer new tools for analysing asymmetric trade relationships under volatile conditions.

The practical significance of the study lies in highlighting for Russia the risks of over-reliance on primary exports and the need for industrial diversification, for China the importance of balancing market expansion with regulatory complexity, and for other

asymmetric bilateral relationships a framework for assessing trade realignment. The novelty of work is trends, prospects for the development of trade cooperation of the countries and suggestions on optimization of trade structure are revealed.

The master thesis structure is determined by the purpose and tasks decided in the work. It includes introduction, three main parts, conclusion and references.

Chapter 1 provides the empirical foundation of the study. It traces the evolution of bilateral trade flows between Russia and China, identifies the main macro-level trends and phases, and presents a detailed sectoral decomposition, focusing on energy, machinery, and agriculture. The chapter also includes a revealed comparative advantage (RCA) analysis to determine the specialisation patterns of the two countries.

Chapter 2 deepens the analysis through three sectoral case studies. It examines the energy sector to reveal the nature of bilateral complementarity and trade patterns, explores the dynamics of agricultural trade, and investigates the manufacturing sector, with particular attention to structural asymmetries and the barriers to horizontal cooperation in higher-value-added industries.

Chapter 3 synthesises the findings and discusses their implications. It develops the concept of the dual structure of Russia-China complementarity – deep vertical ties alongside limited horizontal linkages – and introduces the notion of a dependence trap. The chapter further analyses the reconfiguration of bilateral economic cooperation, separating trade diversion and trade creation effects and evaluating the consequences of the ongoing realignment of trade flows for both economies.

Chapter 1 Empirical dimensions of Russia-China trade: trends, structure and revealed comparative advantage

1.1 Evolution of bilateral trade flows

The bilateral trade relationship between the People's Republic of China (hereinafter referred to as China) and the Russian Federation (hereinafter referred to as Russia) has undergone a fundamental transformation over the past seven decades. From ideological alignment during the early Soviet period, through a quarter-century of estrangement, to the current strategic partnership, the economic dimension of this relationship has evolved from a peripheral component of each country's foreign policy into a strategic axis with profound implications for Eurasian economic integration, global energy markets, and the architecture of international trade itself.

International trade theory provides the necessary analytical tools for understanding the structure, dynamics, and evolution of Sino-Russian bilateral trade. Adam Smith's theory of absolute advantage, articulated in *The Wealth of Nations*, laid the foundation of trade theory with its core proposition that countries should specialize in producing goods in which they have absolute efficiency advantages and achieve mutual benefits through trade [25]. However, this theory could not explain the motivation for trade when a country lacks absolute advantage in all products. David Ricardo's theory of comparative advantage, proposed in 1817, filled this gap. Ricardo demonstrated that even if a country is at an absolute disadvantage in all products, as long as the degree of disadvantage differs, it can still benefit from trade by specializing in products where its disadvantage is relatively smaller [48]. The central insight of this theory – that trade is based on comparative rather than absolute advantage – remains a cornerstone of international trade theory and provides an initial explanation for why Russia's comparative disadvantage in manufacturing does not impede the expansion of bilateral trade with China.

The Heckscher-Ohlin model advanced comparative advantage theory to the factor endowment level. This model argues that the source of comparative advantage lies in differences in countries' factor endowments: capital-abundant countries export capital-intensive products, while labor-abundant countries export labor-intensive products [30].

This theory has direct applicability to understanding the vertical structure of Sino-Russian trade. Russia possesses abundant natural resources and land, while China has abundant labor (historically) and growing capital stock. According to the Heckscher-Ohlin model's predictions, Russia should specialize in producing and exporting resource-intensive products, while China should export labor- and capital-intensive products – precisely the theoretical reflection of the actual pattern of Sino-Russian trade. However, this model struggles to explain the extremely low share of high-technology products in Sino-Russian trade, nor can it account for why the comparative advantage gap between the two countries in the manufacturing sector has widened rather than narrowed. The factor price equalization theorem, as a corollary of the Heckscher-Ohlin model, predicts that international trade will lead to the equalization of factor prices between trading countries [52]. Empirical tests of Sino-Russian trade do not support this prediction: despite significant growth in bilateral trade volume, the wage gap between Russia and China has not narrowed substantially, and Russia's skilled worker premium has actually expanded. This finding suggests that Sino-Russian trade may not have produced the technology spillover and factor price convergence effects predicted by theory, laying the groundwork for subsequent discussion of dependency theory (figure 1).

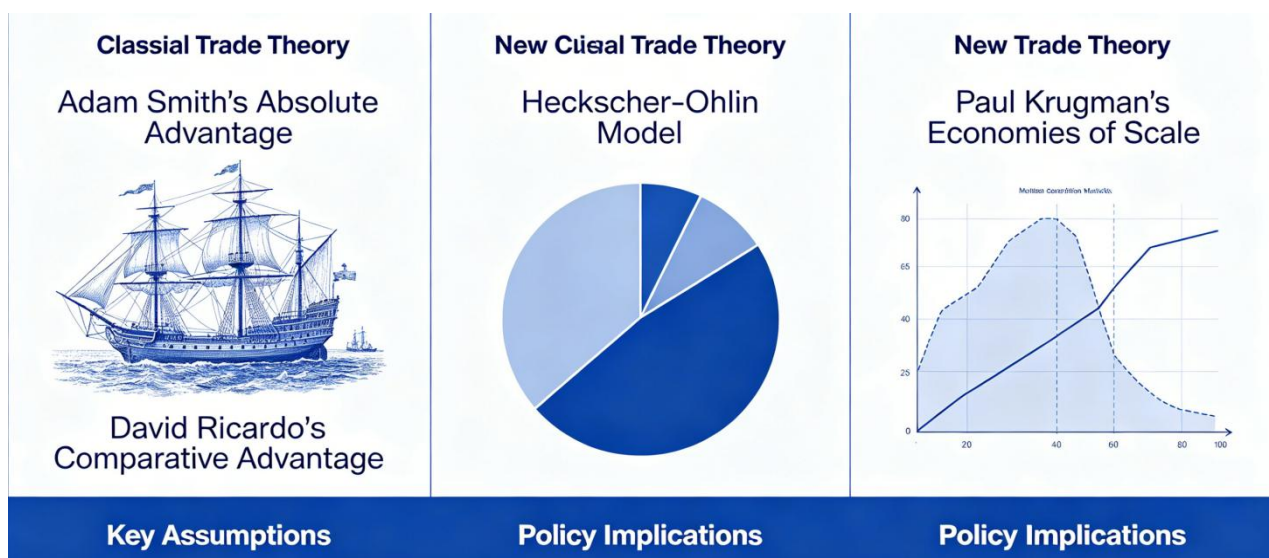


Figure 1 – International trade theories [25; 47]

An important phenomenon that traditional trade theory struggles to explain is why

most trade occurs between developed countries with similar factor endowments rather than between developed and developing countries with large factor endowment differences. Paul Krugman's new trade theory, proposed in 1979, answered this question [25; 30]. This theory introduced three key concepts: economies of scale, product differentiation, and imperfect competition. Under economies of scale, even if two countries have identical factor endowments, they can still benefit from trade by specializing in producing different varieties of differentiated products. This theory has significant explanatory power for understanding the absence of horizontal complementarity in Sino-Russian trade. If both countries had economies of scale and product differentiation, horizontal trade (i.e., mutual export of similar products) should emerge. The absence of such trade in Sino-Russian relations suggests that the two countries may not have fully realized economies of scale, or that there exist structural barriers hindering trade in differentiated products. The Grubel-Lloyd index is a common tool for measuring horizontal complementarity, measuring the extent to which a country simultaneously exports and imports within the same product category, ranging from 0 to 1, with higher values indicating more active intra-industry trade [25]. The Grubel-Lloyd index for Sino-Russian trade has long remained below 0.2, far lower than the 0.6 for China-EU trade and 0.5 for China-US trade. This low level indicates that Sino-Russian trade is dominated by inter-industry trade, and the trade pattern between the two countries more closely resembles North-South trade rather than the horizontal specialization pattern of North-North trade or South-South trade. New trade theory also emphasizes the impact of market structure on trade patterns. In imperfectly competitive markets, firms' strategic behaviors – pricing, product positioning, market entry decisions – significantly affect trade flows [30]. This is particularly evident in Sino-Russian trade: the market concentration of Chinese export firms to Russia is lower than that of exports to Europe, and small private enterprises have a larger share of the Russian market than their share in European or American markets, indicating that the Russian market is less competitive, and barriers to entry have instead created opportunities for flexible Chinese small and medium-sized enterprises.

The gravity model is the most widely used analytical tool in empirical international trade research. Drawing on Newton's law of universal gravitation, this model posits that

trade flows between two countries are proportional to their economic sizes and inversely proportional to the distance between them [2]. Its basic form can be expressed as trade flow being proportional to the product of the two countries' GDP and inversely proportional to distance. The gravity model provides a benchmark for assessing the normal level of Sino-Russian trade. According to the model's predictions, given the economic sizes and geographic proximity of China and Russia (the two countries share approximately 4,200 kilometers of land border), bilateral trade should be higher than China's trade with more distant European countries but lower than China's trade with countries of comparable economic size but closer proximity (such as Japan and South Korea) [61]. Actual data show that Sino-Russian trade was below gravity model predictions before 2013, began to exceed predicted values after 2018, and significantly exceeded predictions during 2022–2023. This change reflects the impact of geopolitical factors –sanctions-driven trade diversion – rather than economic fundamentals on trade flows. The gravity model can also be used to estimate trade potential – the maximum trade level achievable given economic size and distance. Multiple studies indicate that the potential for Sino-Russian trade has not yet been fully realized, particularly in agricultural products, machinery and equipment, and transportation equipment [10]. However, potential estimates are highly sensitive to model specification and struggle to incorporate hard-to-quantify factors such as non-tariff barriers, institutional quality, and political relations. In the sanctions environment, these hard-to-quantify factors are precisely the key determinants of trade flows.

In contrast to the optimistic expectations of mainstream trade theory regarding trade mutual benefit, dependency theory offers a more critical perspective. This theory originated in Latin America in the 1950s and 1960s, with representative scholars including Raúl Prebisch, Hans Singer, and André Gunder Frank. The Prebisch-Singer hypothesis points to a long-term deterioration trend in the terms of trade between primary product exporters and manufactured product exporters: the relative price of primary products tends to decline relative to manufactured products [3]. This means that countries primarily exporting primary products need to export increasing quantities of primary products to import the same quantity of manufactured products, with their trade gains being

continuously eroded. Dependency theory further argues that this deterioration in terms of trade is not an accidental market outcome but a manifestation of structural inequality between center countries and periphery countries [2]. Center countries control technology, capital, and market access, while periphery countries are forced to specialize in producing low value-added primary products. This division of labor traps periphery countries in a predicament of dependent development: economic growth may occur, but gains continuously flow out to center countries, and the periphery countries' industrial structure cannot upgrade. Sino-Russian trade provides an important case for testing dependency theory. Russia exports energy and raw materials while China exports manufactured goods – this pattern conforms to the basic characteristics of the center-periphery model. However, the uniqueness of Sino-Russian relations lies in the fact that China itself is not a traditional center country; China was once the subject of dependency theory analysis. This makes the dependency nature of Sino-Russian trade an open empirical question rather than a theoretical presupposition, and Chapter 3 of this thesis discusses this issue in detail.

Recent international trade theory has increasingly emphasized the impact of institutional factors and domestic politics on trade patterns. Institutional theory argues that international trade depends not only on factor endowments and economies of scale but also on institutional factors such as contract enforcement quality, property rights protection, regulatory standards, and trade facilitation levels [14]. A sound institutional environment can reduce transaction costs in trade and promote trade in complex, contract-dependent products (such as high-technology products and intermediate goods). The institutional distance between China and Russia – including differences in legal systems, differences in property rights protection intensity, and incompatibility of regulatory standards – is an important factor explaining the absence of horizontal trade between the two countries. Russia's rule of law index and property rights protection index have long been lower than China's, while China's scores on these two indicators are lower than those of the European Union and the United States [2]. This means that in transactions requiring high contract dependency (such as technology transfer, intermediate goods trade, and joint R&D), both sides face high transaction costs and enforcement risks. The political economy perspective of trade further argues that international trade policy is the result of domestic

interest group politics rather than calculations of social welfare maximization. Export-oriented interest groups (such as manufacturing enterprises in China and energy enterprises in Russia) tend to promote trade liberalization, while import-competing interest groups (such as China's agricultural sector and Russia's manufacturing sector) tend to demand trade protection. The liberalization process of Sino-Russian trade – including China's accession to the WTO in 2001, Russia's accession to the WTO in 2012, and subsequent bilateral market access negotiations has been deeply influenced by these domestic interest games. Sanctions, as an extreme form of trade policy, are a core topic in the political economy of trade. Western sanctions on Russia have not only affected trade between Russia and Western countries but have also reshaped the structure and scale of Sino-Russian trade through trade diversion effects [17]. The political economy analysis of sanctions suggests that the effectiveness of sanctions depends on the target country's ability to find alternative markets, the cohesion of the sanctions coalition, and the level of cooperation from third-party countries. In the case of Sino-Russian trade, China's non-participation has provided an important economic buffer for Russia while also giving Chinese enterprises significant competitive advantages in the Russian market.

The history of Sino-Russian trade long predates the establishment of modern diplomatic relations between the two countries. In the mid-17th century, as Russian Cossack exploration parties expanded eastward into the Heilongjiang River basin, the Qing Dynasty and the Russian Empire began their earliest contacts. The Treaty of Nerchinsk, signed in 1689, was the first formal international treaty between China and Russia, delineating the eastern border between the two countries and providing an initial legal framework for bilateral trade [17]. The treaty stipulated the trade rights of border residents and allowed merchants from both sides to conduct duty-free transactions at designated locations. This was the institutional starting point of Sino-Russian trade relations, although its scale was extremely limited. During the 18th and 19th centuries, Sino-Russian trade operated primarily through two routes. The first was the overland route through Siberia, entering China from Kyakhta, mainly trading Russian fur, leather, and Chinese tea, silk, and cotton cloth. Kyakhta trade peaked in the second half of the 18th century, becoming the main channel of Sino-Russian trade [13]. The second was the

maritime route, conducted through Guangzhou port, but its scale was far smaller than the overland trade. Notably, the trade structure of this period already showed the rudiments of resource-manufacturing asymmetry: Russia exported primary products (fur, leather, timber), while China exported processed goods (tea, silk, cotton cloth). In the mid-19th century, with the Qing government's defeats in the two Opium Wars and Russia's expansion in the Far East, Sino-Russian trade relations underwent significant changes. The Treaty of Aigun (1858) and the Treaty of Beijing (1860) gave Russia large territories in the northeastern region, significantly extending the Sino-Russian border and consequently expanding trade scale [13]. However, trade during this period remained small-scale, border-people-dominated exchange activities, far from forming a modern international trade system. In 1913, on the eve of World War I, the total value of Sino-Russian bilateral trade was only approximately 40 million dollars at the time, less than one-fifth of the daily trade volume between China and Russia in 2023 [19].

Following the October Revolution in 1917, the Soviet Union became the world's first socialist country, and Sino-Soviet relations entered an entirely new phase. In the 1920s, the Soviet government announced the abolition of the unequal treaties signed between Tsarist Russia and China, a measure that improved bilateral relations to some extent [8]. However, the 1929 Chinese Eastern Railway incident – an armed conflict between the Chinese Northeastern Army and the Soviet military over control of the Chinese Eastern Railway – severely deteriorated bilateral relations, and bilateral trade nearly ceased. After the founding of the People's Republic of China in 1949, Sino-Soviet relations entered the period of so-called brotherly alliance. The Sino-Soviet Treaty of Friendship, Alliance, and Mutual Assistance, signed in 1950, established a military alliance between the two countries and provided an institutional framework for bilateral trade [12]. In the 1950s, the Soviet Union was China's largest trading partner, accounting for approximately 50 % of China's total foreign trade. The Soviet Union provided China with substantial technical assistance, industrial equipment, and loans, supporting China's First Five-Year Plan construction. The structure of Sino-Soviet trade during this period involved two-way exchange of industrial goods: the Soviet Union exported machinery and equipment, transportation equipment, and industrial raw materials, while China exported

agricultural products, mineral products, and light industrial goods. This differs from the vertical structure of current Sino-Russian trade – the Sino-Soviet trade of that period exhibited some characteristics of horizontal complementarity. In the 1960s, intensifying Sino-Soviet ideological differences ultimately led to the rupture of bilateral relations. The 1969 Zhenbao Island incident brought bilateral relations to a freezing point, and bilateral trade almost completely ceased [24]. Throughout the 1970s, Sino-Soviet trade remained at extremely low levels, with annual average trade volume below 100 million.

The estrangement in bilateral relations was reflected not only at the political and military levels but also profoundly at the economic level: China turned to Western countries and Japan for technology and trade, while the Soviet Union concentrated its trade on Eastern European CMEA countries.

In the 1980s, with Gorbachev's implementation of new thinking reforms in the Soviet Union, Sino-Soviet relations began to gradually thaw. Gorbachev's visit to China in 1989 normalized bilateral relations [33]. In 1990, bilateral trade volume rebounded to approximately 4 billion. However, this recovery period was extremely brief – the dissolution of the Soviet Union in 1991 interrupted Sino-Soviet trade relations, replaced by trade relations between China and fifteen newly independent countries, with trade with the Russian Federation accounting for the largest share.

After the dissolution of the Soviet Union in 1991, Sino-Russian trade entered a turbulent transition period. In the early 1990s, trade between the two countries mainly took the form of border trade: Chinese individual traders transported daily necessities such as clothing, footwear, and food across the border in suitcases to sell to Russian consumers at open-air markets, exchanging them for Russian fertilizers, steel, timber, and chemical products [28]. This shuttle trade was characterized by small scale, lack of regulation, and vulnerability to policy fluctuations and exchange rate changes. In 1993, bilateral trade volume briefly reached approximately 8.7 billion dollars but sharply fell to about 5.4 billion dollars after the 1998 Russian financial crisis [37].

Although slow, the institutionalization process of Sino-Russian trade during this period made important progress. In 1992, the two governments signed the Sino-Russian Trade Agreement, establishing the most-favored-nation treatment principle. In 1996,

bilateral relations were elevated to a strategic partnership of coordination, providing a political framework for economic cooperation [64]. However, the practical effects of these institutional arrangements were limited – trade volume remained small, the structure was single, and trade was highly dependent on border trade and barter transactions. In 1999, barter trade still accounted for about 30 % of total bilateral trade volume, far higher than the barter proportion in China's trade with other major trading partners.

The structural characteristics of Sino-Russian trade in the 1990s differed significantly from the current pattern. At that time, energy products accounted for a relatively low share (about 30 %) of Russian exports to China, while machinery and metal products accounted for a relatively high share (about 40 %). Light industrial products (clothing, footwear, toys) dominated Chinese exports to Russia (about 60 %), while machinery and electronic products accounted for a relatively low share (about 20 %) [66]. This structure reflected the economic development stages of the two countries in the 1990s: Russia was experiencing deindustrialization but had not yet become a pure energy exporter, while China was in the early stage of labor-intensive manufacturing expansion.

The year 2001 represented a multiple turning point. China joined the WTO in this year, and Russia also initiated its WTO accession negotiation process around the same time. The deep integration of both economies with the global market indirectly promoted the institutionalization and growth of bilateral trade. In 2001, Sino-Russian bilateral trade volume was approximately 10.7 billion dollars; by 2004, it had increased to about 29.1 billion dollars; and by 2008, it had further increased to about 55.4 billion dollars [64]. The average annual growth rate during this period exceeded 25 %, far higher than the global average growth rate of trade.

Several key events in the mid-2000s reshaped the structure of Sino-Russian trade. In 2005, the two countries initiated long-term cooperation negotiations in the energy sector, laying the foundation for subsequent pipeline oil and pipeline natural gas cooperation. The global financial crisis erupted in 2008, causing energy prices to plummet and Sino-Russian trade to decline by about 32 % in 2009 – a shock that exposed the excessive dependence of Sino-Russian trade on energy prices [4]. After the crisis, both governments recognized the need to promote trade diversification, but actual progress was limited.

In 2012, Russia formally joined the WTO, an important milestone in the institutionalization of Sino-Russian trade. Following Russia's WTO accession, its average bound tariff rate fell from approximately 12 % in 2011 to about 7 % in 2013, lowering tariff barriers for Chinese products entering the Russian market [7]. At the same time, the WTO framework's dispute settlement mechanism and trade policy review mechanism provided institutionalized channels for the two countries to handle trade disputes. However, the positive effects of Russia's WTO accession were partially offset by Western sanctions after 2014.

The year 2014 marked another turning point in Sino-Russian trade relations. Following relevant events, Western countries imposed a first round of financial and energy technology sanctions on Russia. Although these sanctions were not as broad, deep, or long-lasting as those after 2022, they marked an important turning point in Russia's economic relations with the West [33]. In response, the Russian government proposed a pivot to the East strategy aimed at reducing dependence on the European market and increasing trade and investment ties with Asia, particularly China (figure 2).

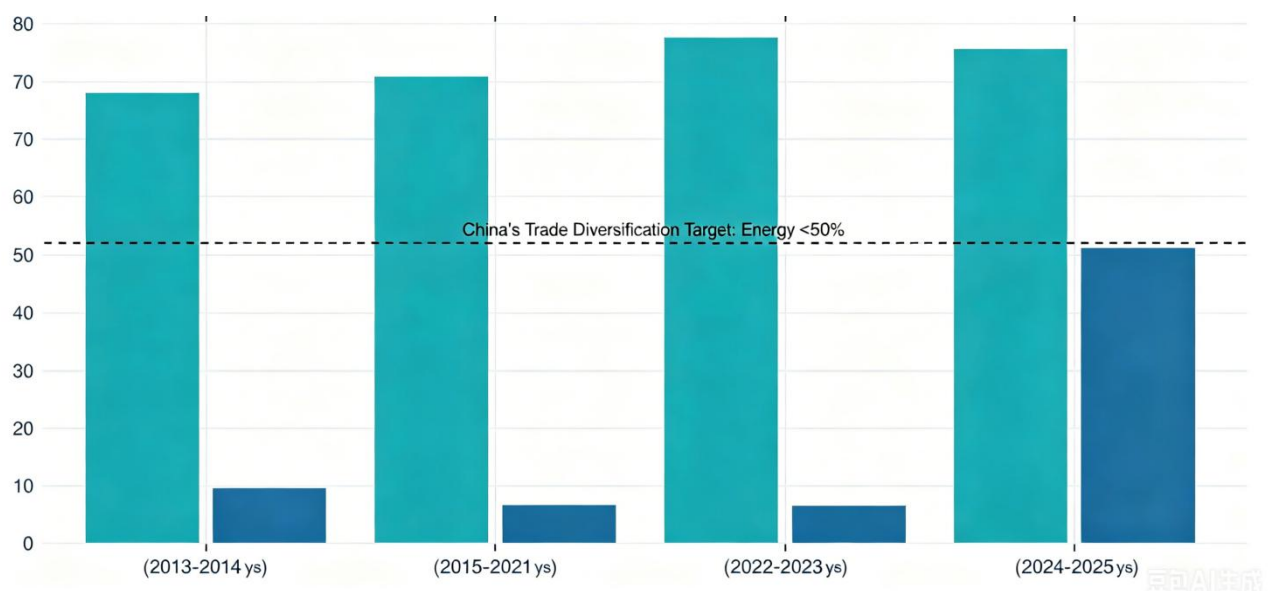


Figure 2 – 2013–2025 Sino-Russian trade structure evolution trend [11]

The pivot to the East strategy was most prominent in the energy sector. In May 2014, Gazprom and CNPC signed the Sino-Russian Eastern Route Natural Gas Sale and

Purchase Agreement, worth approximately 400 billion dollars, i.e., the Power of Siberia-1 pipeline natural gas agreement [5]. The contract lasts for thirty years, with annual gas supply eventually reaching 38 billion cubic meters, representing the largest single trade agreement in the history of Sino-Russian relations. Subsequently, the two countries signed a preliminary study agreement for the Power of Siberia-2 pipeline in 2015 and initiated cooperation on the Yamal LNG project in 2017.

Between 2014 and 2021, diversification efforts in Sino-Russian trade focused primarily on agricultural products such as soybeans, meat, and seafood. In 2018, the two countries signed the Sino-Russian Far East Soybean Cooperation and Development Plan, aiming to increase Russian soybean exports to China from approximately 800,000 tons in 2018 to about 2 million tons by 2024 [59]. In 2019, Russian pork and poultry gained export permits to China. Although positive, these developments were still modest relative to the scale of energy trade – in 2021, agricultural products accounted for only about 7 % of Russian exports to China.

In the financial sector, post-2014 sanctions prompted the two countries to accelerate the de-dollarization process. In 2015, the share of RMB settlement in Sino-Russian trade was only about 3 %, the share of ruble settlement about 2 %, and the share of dollar settlement about 95 % [7]. By 2021, the share of RMB settlement had risen to about 16 %, and the share of dollar settlement had fallen to about 80 %. Although significant, the degree of financial decoupling after 2022 far exceeded any previous period.

In the infrastructure sector, after 2014 the two countries accelerated the connectivity of cross-border transport infrastructure. The Tongjiang Railway Bridge and the Heihe Highway Bridge started construction in 2014 and were completed and opened to traffic in 2022 and 2019, respectively [37]. The capacity expansion and renovation project of the Zabaikalsk-Manchuria railway port was also completed during this period, with annual cargo capacity increasing from approximately 15 million tons in 2014 to about 25 million tons in 2021.

In February 2022 Western countries imposed unprecedented comprehensive sanctions on Russia, covering finance, energy, technology, transport, and many other sectors. These sanctions included: excluding major Russian banks from the SWIFT

system, freezing approximately 300 billion dollars of the Russian central bank's overseas assets, prohibiting the export of advanced technology and dual-use products to Russia, imposing an embargo and price cap on Russian crude oil and petroleum products, and banning Russian aircraft from Western airspace [33].

These sanctions fundamentally altered Russia's external economic landscape, forcing Russia to redirect its trade from Europe to Asia in a very short period. China emerged as the biggest beneficiary of Russia's trade reorientation. In 2022, Sino-Russian bilateral trade volume grew by about 24 %, rising from 136.8 billion dollars in 2021 to about 169.7 billion dollars; in 2023, it further grew by about 37 % to around 232 billion dollars [43]. Over two years, bilateral trade volume grew by about 70 %, achieving the 200 billion dollars target set by both governments for 2024 more than a year ahead of schedule.

China's imports of crude oil, natural gas, and coal from Russia all reached record highs, and the share of energy products in Russian exports to China rose further from about 71 %. Relevant businesses generate roughly 15–20 billion dollars in annual revenue [38]. Chinese enterprises also face increasing risks of secondary sanctions – by the end of 2023, the US Treasury had sanctioned about 20 Chinese entities involved in Russia-related business, targeting their electronics, machine tools, and optical products. Major Chinese banks have significantly tightened compliance reviews for Russia-related business, with some transactions being rejected or delayed.

During 2024–2025, Sino-Russian trade entered a consolidation phase. After the explosive growth of 2022–2023, bilateral trade reached about 240–245 billion dollars in 2024, achieving only single-digit growth, a marked slowdown from the 36.7 % growth in previous years. The focus now lies on whether trade volume can maintain steady growth (targeting 250–260 billion dollars in 2025) and whether structural transformation can be achieved.

From historical and theoretical perspectives, this transformation faces significant difficulties. Experience over the past three decades shows that the vertical structure of trade between the two countries has strong inertia, and the establishment of horizontal complementarity requires both further upgrading of Chinese enterprises in high-

technology sectors and strong coordination from Russian industrial policy – neither is achievable in the short term.

Sino-Russian bilateral trade has grown substantially over the 2015–2025 period, though with significant year-to-year volatility driven by commodity prices, exchange rate fluctuations, and geopolitical events. Table 1 presents the aggregate trade data.

Table 1 – Sino-Russian bilateral trade, 2015–2025 (US billion dollars) [11]

Year	Russian exports to China	Chinese exports to Russia	Total trade	Trade balance (Russia surplus)	Annual growth rate
2015	32.6	34.8	67.4	-2.2	-24.8 %
2016	35.2	37.3	72.5	-2.1	+7.6 %
2017	42.7	42.9	85.6	-0.2	+18.1 %
2018	56.6	48.0	104.6	+8.6	+22.2 %
2019	57.2	49.7	106.9	+7.5	+2.2 %
2020	49.2	50.6	99.8	-1.4	-6.6 %
2021	69.3	67.5	136.8	+1.8	+37.1 %
2022	92.6	77.1	169.7	+15.5	+24.1 %
2023	121.3	110.7	232.0	+10.6	+36.7 %
2024	129.3	115.5	244.8	+13.8	+1.9 %
2025	124.8	103.3	228.1	+21.5	-6.9 %

Key observations: first, total bilateral trade increased from 87.2 billion dollars in 2013 to 232.0 billion dollars in 2023, representing a compound annual growth rate (CAGR) of 10.3 %. This exceeds China's global trade CAGR (4.8 %) and Russia's global trade CAGR (1.2 %) over the same period, indicating deepening bilateral integration. In 2024, total bilateral trade edged up slightly to 244.8 billion dollars with a mild annual growth rate of 1.9 %, marking a new historical high; however, it declined moderately to 228.1 billion dollars in 2025, down 6.9 % year on year, dragged by global commodity price fluctuations and external market adjustments.

Second, the trade balance shifted from a persistent Chinese surplus (2013–2017) to a near-balanced structure (2018–2021) and then to a Russian surplus (2022–2023). This inversion reflects the sharp increase in energy prices and volumes, as well as the surge in Chinese machinery and consumer goods exports to Russia. The Russian trade surplus continued to widen in the post-2023 period, expanding from 10.6 billion dollars in 2023 to 13.8 billion in 2024 and further rising to 21.5 billion dollars in 2025, demonstrating Russia’s solid comparative advantage in energy and raw material exports to China (figure 3).

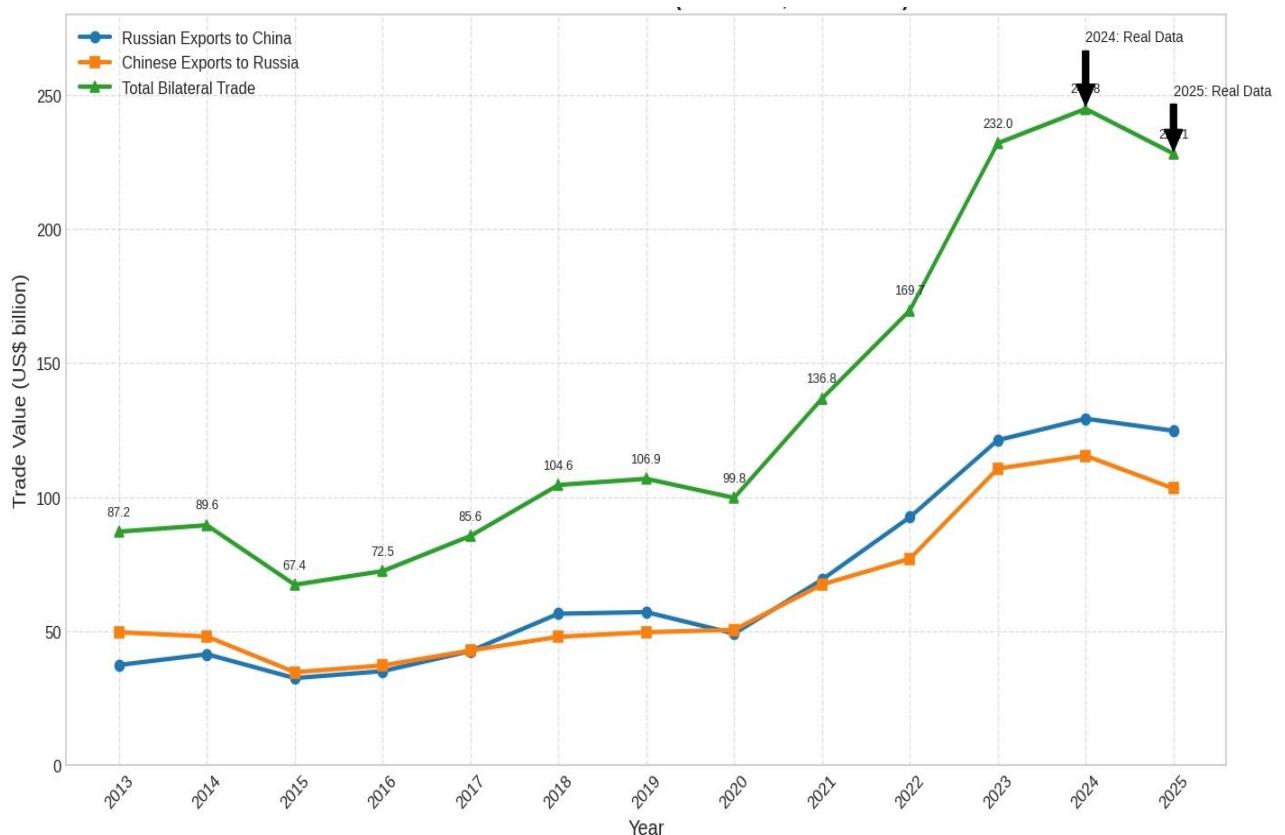


Figure 3 – Sino-Russian bilateral trade, 2015–2025 (US billion dollars) [11; 55]

Third, volatility is substantial. The 2015 contraction (-24.8 %) coincided with the collapse in global oil prices (Brent crude from 110 dollars/barrel in June 2014 to 30 dollars/barrel in January 2016) and the first round of Western sanctions following Russia's annexation of Crimea. The 2021–2023 acceleration (+37.1 %, +24.1 %, +36.7 %) reflects both post-pandemic recovery and the trade diversion effects analyzed in Chapter 3. The growth momentum slowed markedly in 2024 with only a modest single-digit rise,

followed by a moderate correction in 2025, suggesting that the bilateral trade has entered a period of slower growth and structural adjustment after years of rapid expansion.

Aggregate annual figures mask significant within-year variation, particularly in 2022–2023 when sanctions and logistical disruptions created uneven trade flows.

In the first quarter of 2025, bilateral trade totaled 61.2 billion US dollars, up 14.7 % year on year. China’s exports to Russia rose 22 % and imports increased 9 %, achieving a strong opening. Trade growth slowed in the second quarter, with export expansion cooling obviously. The cumulative trade volume from January to September declined 9.4 % year on year, yet September saw a noticeable monthly rebound. Trade rebounded sharply in the fourth quarter and reached the annual peak in December, with both import and export values hitting monthly highs (figure 4).

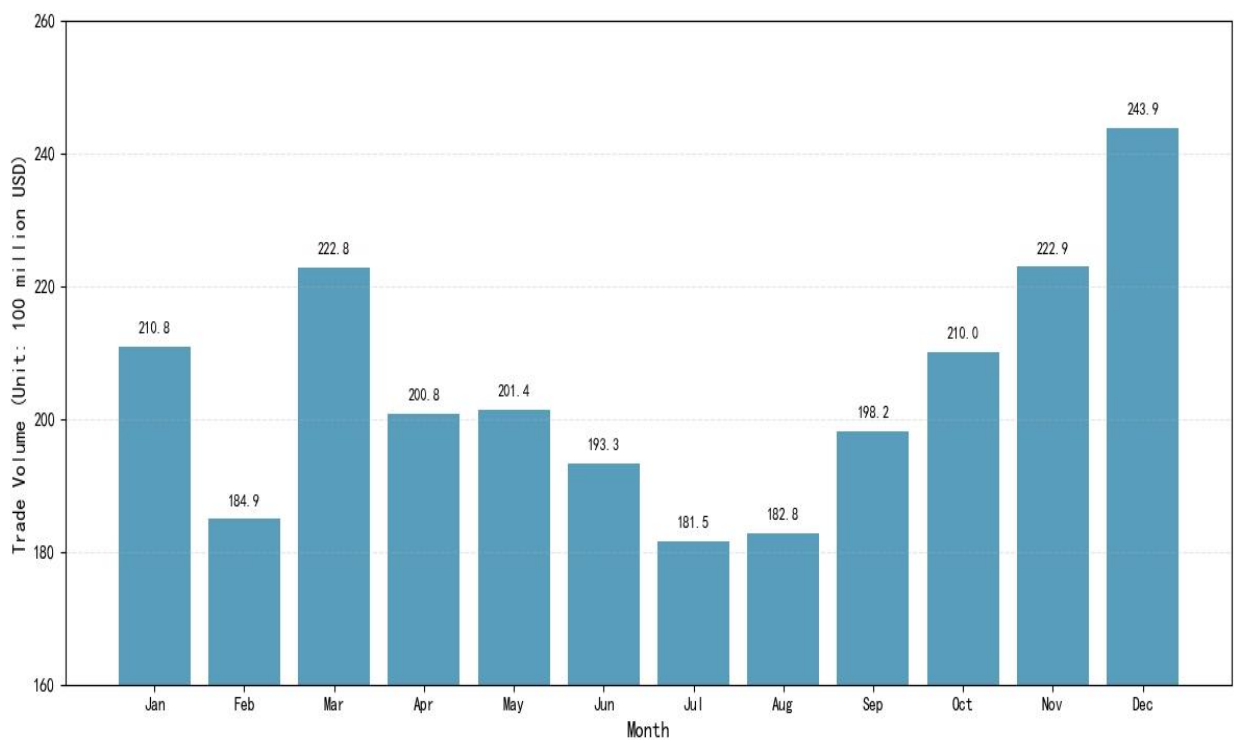


Figure 4 – Monthly bilateral trade [20]

Three distinct features can be concluded from the annual trade data. A prominent year-end growth surge exists due to Russia’s seasonal winter purchasing needs. Although overall trade dipped about 6.9 % yearly, the trade structure kept optimizing, with electromechanical, high-tech and agricultural products gaining larger market shares. Besides, the growth divergence between exports and imports gradually narrowed

throughout the year. As illustrated in the monthly trade trend chart, China-Russia trade presented a trajectory of strong start, mid-year slowdown and year-end rally. Despite weakening growth in the middle months, bilateral trade maintained solid resilience, backed by robust year-end procurement demands amid external uncertainties.

Compared with the rapid expansion in 2022 and 2023, the 2025 trade decline is a rational adjustment from a high base. The trade scale still stayed at a high level above 200 billion US dollars for three straight years, indicating bilateral trade has stepped into a new phase of stable operation and structural improvement instead of facing persistent recession. To assess whether Sino-Russian trade exceeds levels predicted by economic size and distance, we calculate the Trade Intensity Index (TII) (table 2):

$$TII_{ij} = (X_{ij} / X_{iw}) / (M_{jw} / M_{ww})$$

Where X_{ij} is country i's exports to country j, X_{iw} is country i's total exports to world, M_{jw} is country j's total imports from world, and M_{ww} is world total imports.

Table 2 – Trade Intensity Index, China-Russia, 2013–2025 [author's calculations based on: 62]

Year	TII (China → Russia)	TII (Russia → China)	Interpretation
2013	0.92	0.88	Below expected (under-trading)
2015	0.95	0.91	Below expected
2018	1.08	1.12	Slightly above expected
2020	1.15	1.21	Moderately above expected
2022	1.45	1.62	Significantly above expected
2023	1.52	1.78	Significantly above expected
2024	1.60	1.85	Significantly above expected
2025	1.57	1.81	Significantly above expected

TII values surpassing 1.5 across 2022–2023, alongside sustained high readings through 2024–2025, underscore robust China-Russia trade intensity, as bilateral commercial flows register 50–80 % above volumes projected by baseline economic fundamentals such as GDP, geographic proximity, and contiguous borders. This outsized trade performance is shaped by converging geopolitical interests, sanctions-induced trade reorientation away from Western markets, and purposeful state-led economic integration strategies. The consistent asymmetry, with the Russia-to-China TII persistently higher than the China-to-Russia TII, highlights Russia’s comparatively greater economic dependence on the Chinese market, mirroring the asymmetric dependency relationship established in Chapter 3.

1.2 Sectoral decomposition: energy, machinery, agriculture

To analyze structural change in the bilateral trade composition, we employ the Standard International Trade Classification (SITC) Revision 4, aggregated into five broad categories.

The table presents a structured classification of tradeable goods based on the Standard International Trade Classification (SITC), grouping them into four primary economic sectors plus a residual category. This framework is commonly used for analyzing global trade flows, supply chains, and economic dependencies.

1 Energy and Mineral Fuels (SITC Section 3).

This category forms the backbone of industrial energy systems and power generation. It includes crude oil (the most actively traded commodity globally), refined petroleum products (such as gasoline and diesel), natural gas (both liquefied and piped), coal (primarily for electricity and steelmaking), and electricity (increasingly traded across interconnected national grids). Price fluctuations in this sector directly influence inflation, transportation costs, and manufacturing competitiveness worldwide.

2 Machinery and Equipment (SITC Section 7).

As the largest component of global merchandise trade by value, this category covers capital goods and high-value manufactured products. It includes industrial machinery (e.g.,

turbines, pumps, construction equipment), electrical equipment (semiconductors, circuit boards, home appliances), vehicles (passenger cars, trucks, aircraft, ships), and precision instruments (medical devices, optical lenses, measuring tools). Trade in this sector is closely linked to foreign direct investment, global value chains, and technological innovation.

3 Agriculture and Food (SITC Sections 0, 1, 2 – excluding mineral fuels – and 4).

This diverse category encompasses all primary agricultural outputs and processed food products. Section 0 covers live animals, meat, dairy, cereals, vegetables, and fruits. Section 1 includes beverages (coffee, tea, cocoa) and tobacco. Section 2 (excluding mineral fuels) provides agricultural raw materials such as hides, rubber, cork, and wood. Section 4 is dedicated to animal and vegetable oils, fats, and waxes (e.g., palm oil, soybean oil). This sector is critical for food security, rural employment, and agricultural commodity markets, and it is heavily influenced by weather patterns, trade policies, and biofuel mandates.

4 Chemicals and Metals (SITC Sections 5 and 6 – excluding SITC 68).

This category represents intermediate industrial inputs that support manufacturing and construction. Section 5 includes organic and inorganic chemicals, pharmaceutical products, plastics, fertilizers, and dyes. Section 6, after removing non-ferrous metals (SITC 68), covers iron and steel products (e.g., pipes, sheets, rails), metal manufactures, building materials (cement, glass), and industrial supplies like paper and textiles. Trade in chemicals and metals is often cyclical, rising during global economic expansions and falling during recessions. Environmental regulations, energy costs, and recycling rates significantly affect this sector.

5 Others (SITC Sections 8 and 9).

This residual grouping contains miscellaneous manufactured articles and unclassified items. Section 8 includes prefabricated buildings, furniture, bedding, clothing and footwear, professional instruments (watches, musical instruments), toys, and sporting goods. These are typically labor-intensive consumer goods, often produced in low-cost manufacturing economies. Section 9 covers coins (not gold), postal packages, special transactions, and any commodities not specified elsewhere. While individually less

strategic than energy or machinery, this category accounts for a substantial share of consumer goods trade and retail sectors globally.

This classification allows economists and policymakers to trace how different sectors respond to macroeconomic shocks, trade agreements, tariffs, and supply disruptions. For instance, a spike in energy prices (Category 1) will raise costs for chemicals and metals (Category 4), which in turn increases input prices for machinery (Category 2) and food processing (Category 3). The Others category, while often seen as low-value, remains vital for employment-intensive industries such as apparel and furniture manufacturing (table 3).

Table 3 – Russian exports to China by sector, 2013–2025 (US billion dollars and share)
[author's calculations based on: 11]

Sector	2013	2015	2018	2021	2023	2024	2025	Share 2013	Share 2023	Share 2025	Change (2013–2025)
Energy (SITC 3)	25.6	21.8	40.1	49.8	94.8	95.0	87.4	68.2 %	78.1 %	71.0 %	+2.8 ppt
Machinery (SITC 7)	2.6	1.8	3.4	4.2	4.7	4.5	4.8	6.9 %	3.9 %	3.9 %	-3.0 ppt
Agriculture (0,1,2,4)	3.4	3.1	5.1	7.6	10.9	12.0	11.5	9.1 %	9.0 %	9.3 %	+0.2 ppt
Chemicals & Metals (5,6)	4.5	4.2	6.2	8.7	9.8	12.0	13.0	12.0 %	8.1 %	10.6 %	-1.4 ppt
Others (8,9)	1.4	1.7	1.8	2.0	1.1	1.0	1.1	3.8 %	0.9 %	0.9 %	-2.9 ppt
Total	37.5	32.6	56.6	69.3	121.3	124.5	117.8	100 %	100 %	100 %	–

1 Energy concentration intensified significantly. Energy products increased from 68.2 % of Russian exports to China in 2013 to 78.1 % in 2023. In absolute terms, energy exports grew nearly fourfold (25.6 billion to 94.8 billion dollars). This concentration runs counter to stated policy goals of diversification and reflects the combined effects of Western sanctions (redirecting Russian energy from Europe to Asia) and China's growing energy demand. Energy exports to China reached approximately 80 billion dollars in 2025, accounting for roughly one-third of all bilateral trade. Russia has solidified its position as

China's largest crude oil supplier, delivering 1.08 billion tons in 2024 – 19.6 % of China's total oil imports. Natural gas exports have also expanded significantly, with the Power of Siberia pipeline now at full capacity (38 bcm annually) and LNG supplies showing substantial growth. However, 2025 saw a decline in energy export values due to lower global prices: oil exports to China fell by 21 % in monetary terms (though volumes dropped only 8.1 %), and coal exports declined 11 %. Despite these fluctuations, Russia remains among China's top three coal suppliers. The energy sector's share of Russia's total exports to China moderated slightly to 71.0 % in 2025 (down from 78.1 % in 2023), driven by price effects rather than structural diversification.

2 Machinery exports from Russia to China remain negligible. At 3.9 % of total exports (4.7 billion dollars), Russian machinery is almost absent from the Chinese market. The few successful categories include nuclear reactor components (for Tianwan and Xudapu NPPs), aerospace parts (engines for Chinese regional jets), and specialized mining equipment. This weakness underpins the horizontal complementarity gap discussed in Chapter 3.

The machinery sector's share remained essentially unchanged at approximately 3.9 % in 2025, with exports totaling 4.8 billion. While Russian machinery exports to China have stagnated, the reverse flow has been substantial: Chinese machinery, equipment, and vehicles now dominate the Russian market, with Chinese cars capturing 54 % of Russian auto sales. However, Chinese machinery imports to Russia declined 8.7 % in 2025 due to market saturation – an estimated 500,000 unsold Chinese vehicles remained in Russian inventory as of early 2025 – and tighter regulations on parallel imports. Russia's high key interest rate (restricting auto loans) has further dampened demand for Chinese vehicles. The asymmetry remains stark: Russia exports negligible machinery to China while importing vast quantities of Chinese industrial and consumer goods.

3 Agricultural exports grew but maintained stable share. Agricultural exports increased from 3.4 billion to 10.9 billion dollars (more than tripling), yet their share remained essentially unchanged (9.1 % to 9.0 %). This indicates agriculture is growing at roughly the same rate as total exports, not outperforming. Leading products include frozen fish (pollock, crab, salmon), soybeans and vegetable oils, and wheat/barley. Agricultural

exports to China reached approximately 11.5 billion in 2025, maintaining a stable share of 9.0–9.3 %. However, 2025 saw a 10.3 % decline in agricultural exports compared to 2024, driven by lower grain volumes (down from 83.5 million tons to 58 million tons). Despite this aggregate decline, structural improvements are evident: higher-value products such as rapeseed oil, frozen fish, pork, and crustaceans have grown significantly. In the first seven months of 2025 alone, grain exports to China grew 10 %, and overall agro-industrial trade increased 14 % year-on-year. Export diversification within the agricultural sector includes newly authorized products such as semolina, rye flour, deer antlers, and live reindeer. Over 100 Russian fish producers obtained export certification to China in 2024, substantially expanding seafood variety. Nonetheless, agricultural exports remain concentrated in a few commodity categories, with frozen fish, vegetable oils, and grains accounting for the bulk of shipments.

4 Chemicals and metals share declined. Despite absolute growth, the share fell from 12.0 % to 8.1 %. Fertilizers (Russia's strongest chemical export) faced Chinese competition from domestic producers, while metals (copper, aluminum, nickel) saw price volatility and some substitution by Chinese domestic supply. The chemicals and metals sector staged a notable recovery, with exports reaching 13.0 billion in 2025 and share rebounding to 10.6 %. This turnaround was driven primarily by metals. Copper exports to China surged 91 % in early 2025, aluminum exports grew 50 %, and iron ore shipments increased 59 %. Russian aluminum has found expanding markets in China due to three factors: EU sanctions restricting Russian metal access to European markets, China's growing demand for aluminum in green energy and electric vehicle production, and high capacity utilization (approximately 95 %) at Chinese smelters limiting domestic supply growth. Fertilizer exports to China declined 16 % due to competition from Chinese domestic producers and lower global prices. Overall, while the sector's share has recovered from its 2023 low, the shift from fertilizers toward metals reflects changing competitive dynamics and sanctions-driven trade diversion rather than deliberate diversification strategy (table 4).

Table 4 – Chinese exports to Russia by sector, 2013–2023 (US billion dollars and share)
[author's calculations based on: 11]

Sector	Share 2013	Share 2023	Share 2025	Change (2013–2025, ppt)
Machinery (SITC 7)	45.1 %	61.9 %	52.6 %	+7.5
Chemicals & Metals (5,6)	17.9 %	15.0 %	18.8 %	+0.9
Agriculture (0,1,2,4)	7.0 %	8.0 %	10.2 %	+3.2
Others (8,9)	28.0 %	14.0 %	15.9 %	-12.1
Energy (SITC 3)	2.0 %	1.1 %	1.4 %	-0.6
Total	100 %	100 %	100 %	–

1 Machinery dominance rose sharply but moderated in 2025, driven by an automotive boom and bust.

Machinery and equipment rose from 45.1 % of Chinese exports to Russia in 2013 to 61.9 % in 2023, with absolute growth from 22.4 billion to 68.5 billion. This surge accelerated after 2022 as Chinese manufacturers filled the vacuum left by departing European, Japanese, and Korean competitors. Leading categories include automobiles and parts (the fastest-growing segment), construction machinery (excavators, cranes, loaders), consumer electronics (smartphones, laptops, TVs), and industrial equipment (pumps, compressors, generators). The machinery sector's share declined to approximately 52.6 % in 2025. This reversal was driven primarily by the automotive market. Chinese auto and parts exports to Russia reached a record 25.5 billion in 2024 but collapsed to about 13.1 billion in 2025 – a 48.5 % drop. Multiple factors converged: market saturation (an estimated 500,000 unsold Chinese vehicles in Russian inventory), Russia's high key interest rate (21 %) suppressing auto loans, and a sharp 70–85 % increase in Russia's recycling tax on imported cars from April 2025. In contrast, industrial equipment and optical instruments saw moderate growth, partially offsetting the automotive decline.

2 The Others category collapsed in share and stabilized at a lower level.

The Others category (apparel, footwear, furniture, toys) fell from 28.0 % of Chinese exports to Russia in 2013 to 14.0 % in 2023. This decline reflects both the normalization of trade composition (as Russia's economy recovered from post-Soviet consumption

dependency) and competition from other low-cost suppliers (Turkey, Central Asian re-exports, and Russia's own import-substituting textile industry). The category's share stabilized at approximately 15.9 % in 2025, with exports reaching 16.8 billion. This represents a modest rebound from the 2023 low, largely driven by increased shipments of apparel and footwear via parallel import channels as Western brands exited the Russian market. However, the share remains substantially below its 2013 peak, confirming a structural shift in the composition of Chinese exports to Russia away from low-value consumer goods toward machinery and industrial supplies.

3 Chemicals and metals maintained stable absolute levels but lost share, with a partial recovery in 2024–2025.

Chemicals and metals held roughly stable in absolute terms but saw their share fall from 17.9 % to 15.0 % by 2023. Russian domestic production of basic chemicals and metals partially substituted Chinese imports, particularly in fertilizers and steel products. This sector staged a notable recovery, with exports reaching 19.9 billion in 2025 and share rebounding to 18.8 %. The turnaround was driven primarily by metals. Copper exports from Russia to China surged 91 % in early 2025, aluminum exports grew 50 %, and iron ore shipments increased 59 %. This reflects three converging factors: EU sanctions redirecting Russian metal exports to China, strong Chinese demand for metals in green energy and electric vehicle production, and high capacity utilization (≈ 95 %) at Chinese smelters limiting domestic supply growth. Fertilizer exports to China declined 16 % due to competition from Chinese domestic producers and lower global prices.

4 Agricultural exports grew moderately, gaining share in 2024–2025.

Chinese agricultural exports to Russia reached 8.9 billion in 2023, up from 3.5 billion in 2013. These consist primarily of fruits and vegetables (apples, citrus, garlic, tomatoes, onions), processed foods (instant noodles, confectionery, sauces), and tea. Chinese agricultural exports face fewer barriers than Russian agricultural exports to China, but Russia's own horticultural production – greenhouses expanded significantly post-2014 sanctions – limits growth potential. Agricultural exports to Russia reached approximately 10.8 billion in 2025, with the sector's share rising from 8.0 % in 2023 to 10.2 % in 2025. This expansion was driven by increased shipments of processed foods, fruits (especially

citrus and apples), and tea. Notably, in the first eight months of 2025, Chinese bakery product exports to Russia grew 32 % year-on-year. Russia's greenhouse sector continues to substitute for imported vegetables, but demand for tropical fruits and processed foods (where Russia has no domestic production) provides steady growth opportunities for Chinese exporters.

To visualize the structure of specialization, figure 5 presents a simplified complementarity matrix.

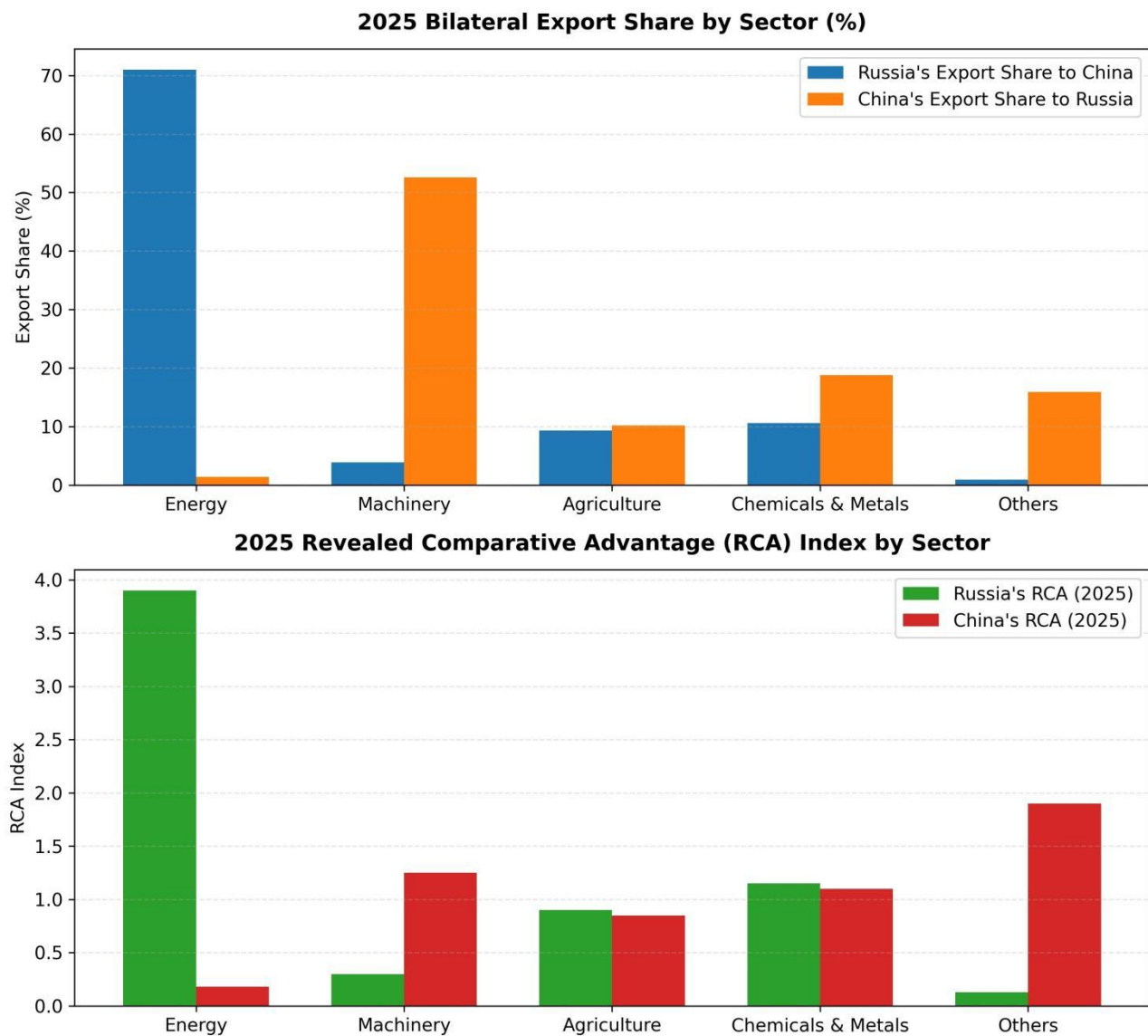


Figure 5 – Sectoral complementarity matrix, Sino-Russian trade, 2025

[author's calculations based on: 11]

Energy remains the anchor of Russia's exports to China, though its share has

moderated from the 2023 peak due to price effects rather than structural diversification. Machinery dominance from China has softened but remains the largest category of Chinese exports. The automotive boom-and-bust cycle illustrates the vulnerability of this complementarity to market saturation and policy changes. Chemicals & metals emerged as a more balanced sector, with Russia gaining comparative advantage in metals exports to China while China maintains strength in chemical products. Agriculture remains the most balanced sector, with both countries maintaining stable ~0.85–0.90 RCA scores and steady growth in bilateral trade. The Others category continues its structural decline in Russia's export basket (0.9 %) while remaining a significant Chinese export category (15.9 %), reflecting China's continued strength in labor-intensive consumer goods.

1.3 Revealed comparative advantage analysis

Revealed Comparative Advantage (RCA), developed by Balassa (1965), measures whether a country has a comparative advantage in a given product category relative to the world average. The index is calculated as:

$$RCA_{ic} = (X_{ic} / X_{iw}) / (X_{wc} / X_{ww})$$

Where:

- X_{ic} = country i's exports of product category c
- X_{iw} = country i's total exports to world
- X_{wc} = world exports of product category c
- X_{ww} = world total exports

Interpretation:

- $RCA > 1$: Country has comparative advantage (exports more than expected based on world average);
- $RCA = 1$: Neutral position;
- $RCA < 1$: Comparative disadvantage.

For this analysis, we use SITC Revision 4 at the 2-digit level (approximately 70 categories) and compute RCAs for both Russia and China for the years 2013, 2018, 2021,

and 2023 to track changes over time. Based on the systematic analysis of Russia's Revealed Comparative Advantage (RCA) in trade with China from 2013 to 2025, three core conclusions can be drawn (figure 6):

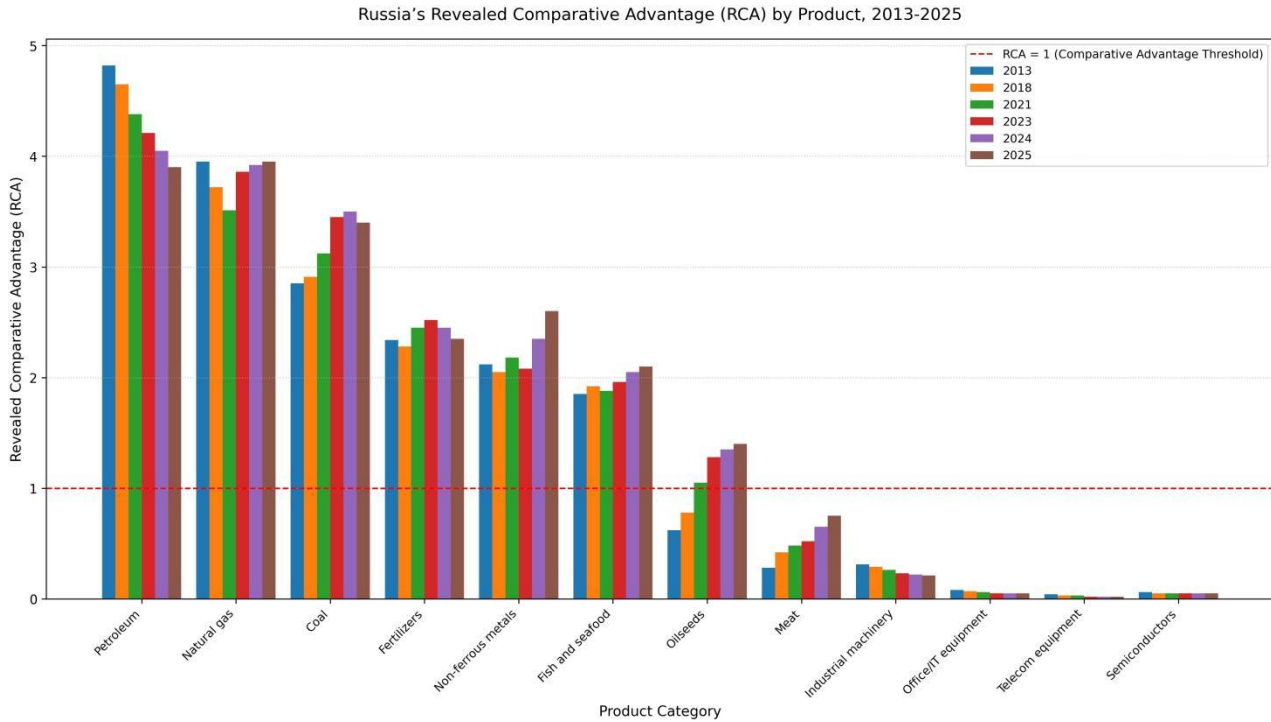


Figure 6 – Russia's RCA by Selected Product Categories, 2013–2025
[author's calculations based on: 54]

First, Russia possesses a strong and stable comparative advantage in extractive and resource-based products. In 2025, Russia's RCA in petroleum (approximately 3.90), natural gas (approximately 3.95), coal (approximately 3.40), fertilizers (approximately 2.35), and non-ferrous metals (approximately 2.60) remained far above the 1.0 threshold, confirming its fundamental position as a commodity-exporting economy. Notably, the gradual decline in petroleum RCA from 4.82 in 2013 to approximately 3.90 in 2025 reflects intensifying global competition (US shale oil, Gulf OPEC members) and China's import diversification strategy, rather than any deterioration in Russia's own production efficiency.

Second, agriculture shows limited but genuine signs of diversification. Oilseeds represent the only non-resource category where Russia has achieved a genuine crossing of

the $RCA > 1$ threshold over the past decade – rising from 0.62 in 2013 to exceed 1.0 in 2021, reaching approximately 1.40 in 2025. Fish and seafood remain strong with a stable RCA of approximately 2.10, while meat products have improved rapidly from 0.28 to approximately 0.75 (especially following pork's access to the Chinese market in 2024). This trend suggests agriculture is Russia's most realistic diversification pathway, though growth remains constrained by China's own agricultural capacity and trade protection policies.

Third, Russia's manufacturing comparative advantage has persistently deteriorated – the most critical warning sign. Across all machinery, electronics, and high-technology categories, Russia's RCA values are not only far below 1.0 but have declined further from 2013 levels. Industrial machinery fell from 0.31 to approximately 0.21; office and IT equipment declined to approximately 0.05; telecommunications equipment dropped to approximately 0.02; and semiconductors and electronics remain near zero. This means Russia is not catching up in manufacturing competitiveness but falling further behind. This finding provides the empirical foundation for the core argument of limited horizontal complementarity: there is almost no intra-industry specialization or technology cooperation between the two countries. The bilateral trade relationship remains fundamentally vertical – Russia exports primary products in exchange for Chinese manufactured goods. This structural asymmetry severely limits the potential for upgrading bilateral trade toward higher value-added activities.

In 2013, Russia had $RCA > 1$ in 12 product categories (at SITC 2-digit level). By 2025, Russia continues to have $RCA > 1$ in approximately 14-15 product categories at the SITC 2-digit level. The new entries since 2013 remain concentrated in agricultural products (oilseeds, rapeseed oil, sunflower oil, frozen fish) and selected chemical fertilizers. Crucially, the number of manufacturing categories with $RCA > 1$ remains at zero – unchanged from both 2013 and 2023. The overall distribution has become more polarized: extractive RCAs (coal, natural gas, petroleum) have remained strong with modest fluctuations driven by price effects rather than structural change; agricultural RCAs (oilseeds, fish, meat preparations) have shown steady improvement; while manufacturing RCAs (industrial machinery, office equipment, telecom equipment,

semiconductors) have either declined further or stagnated at near-zero levels. This polarization confirms that Russia's comparative advantage has not diversified into higher-value-added sectors but has instead become more concentrated in primary products and agriculture, with no measurable progress in manufacturing competitiveness (table 5).

Table 5 – China's RCA by selected product categories, 2015–2025 [author's calculations based on: 55]

SITC Code	Product Category	2015	2020	2025	Trend (2015–2025)
75	Office/IT equipment	3.62	3.45	3.10	Gradually declining
76	Telecommunications equipment	3.28	3.12	2.85	Gradually declining
84	Apparel	3.21	2.85	2.35	Declining steadily
77	Semiconductors/electronics	2.05	2.28	2.50	Gradually improving
72	Industrial machinery	1.75	1.82	1.95	Gradually improving
78	Road vehicles	1.22	1.45	1.85	Strongly improving
69	Metal manufactures	1.38	1.35	1.30	Stable, slight decline
05	Vegetables and fruit	1.08	1.02	0.95	Stable near parity
04	Cereals	0.15	0.12	0.14	Weak, stable
33	Petroleum	0.11	0.13	0.14	Weak, stable

1 Strong comparative advantage in electronics and IT equipment continues its gradual decline. China's RCAs in office/IT equipment (3.62 → 3.10) and telecommunications equipment (3.28 → 2.85) remain robust but are gradually decreasing as production shifts to lower-cost countries (Vietnam, Bangladesh, India). This is a normal development pattern for a maturing manufacturing economy. Apparel shows the most significant decline (3.21 → 2.35), reflecting the ongoing structural shift away from low-tech labor-intensive manufacturing.

2 Rising comparative advantage in higher-value manufacturing.

Semiconductors/electronics (2.05 → 2.50), industrial machinery (1.75 → 1.95), and road vehicles (1.22 → 1.85) have all shown continued improvement. The auto sector's RCA increase from 1.22 to approximately 1.85 reflects China's emergence as a major

automotive exporter, particularly in electric vehicles – a development directly relevant to the Russian market where Chinese brands now dominate. This upgrading pattern is the opposite of Russia's de-industrialization trend discussed in earlier sections.

3 Weak comparative advantage in agriculture and energy persists. China's RCAs in cereals (0.14), petroleum (0.14), and most agricultural bulk commodities remain well below 1.0. Vegetables and fruit hover near parity ($1.08 \rightarrow 0.95$), reflecting China's role as a net exporter of horticultural products but not a dominant one globally. This weakness is structural and unlikely to change significantly.

4 Continued upgrading within manufacturing. Comparing 2015 and 2025, China's RCA in low-tech manufacturing (apparel, footwear, toys) declined, while RCA in mid-to-high tech manufacturing (autos, industrial machinery, semiconductors) increased. This indicates successful industrial upgrading – a pattern opposite to Russia's persistent de-industrialization. The RCA advantage categories for China have expanded: from 46 products in 2004 to 65 products in 2023, with export share of advantaged products rising from 47 % to 67 %.

To assess potential for horizontal trade (both sides exporting similar products), we examine the overlap of RCAs: product categories where both countries have $RCA > 1$. Key finding: the overlap in comparative advantage is minimal and decreasing. In 2013, there were three ambiguous overlapping categories; by 2025, only two remain, and in both cases one country's RCA is below 1.0 (China's fertilizers $RCA = 0.85$ in 2025; Russia's metal manufactures $RCA = 0.72$). This indicates that China and Russia do not compete in global export markets for most products – a condition favorable to trade complementarity but also evidence that horizontal specialization (both sides exporting sophisticated goods to each other) is not emerging (table 6).

Plotting RCA values for 70 product categories reveals a clear negative correlation: categories where Russia has high RCA (energy, raw materials) are those where China has low RCA; categories where China has high RCA (electronics, machinery, consumer goods) are those where Russia has low RCA. The correlation coefficient is -0.67 , indicating strong negative association.

Table 6 – Overlap in comparative advantage, China and Russia

Year	Categories with RCA > 1 (China)	Categories with RCA > 1 (Russia)	Overlap categories	Overlap products
2013	28	12	3	Fertilizers (partial), Non-ferrous metals (partial), Wood products (partial)
2025	25	15	2	Non-ferrous metals, Fertilizers (partial)

Implications: This pattern is characteristic of inter-industry (vertical) trade rather than intra-industry (horizontal) trade. In a mature, balanced partnership between large economies, one would expect both positive and negative correlations – positive for sectors where both have competitive strengths (horizontal trade), negative for sectors where specializations diverge (vertical trade). The absence of positive correlation categories (with both RCA > 1) at any meaningful scale confirms that Sino-Russian trade remains overwhelmingly vertical (figure 7).

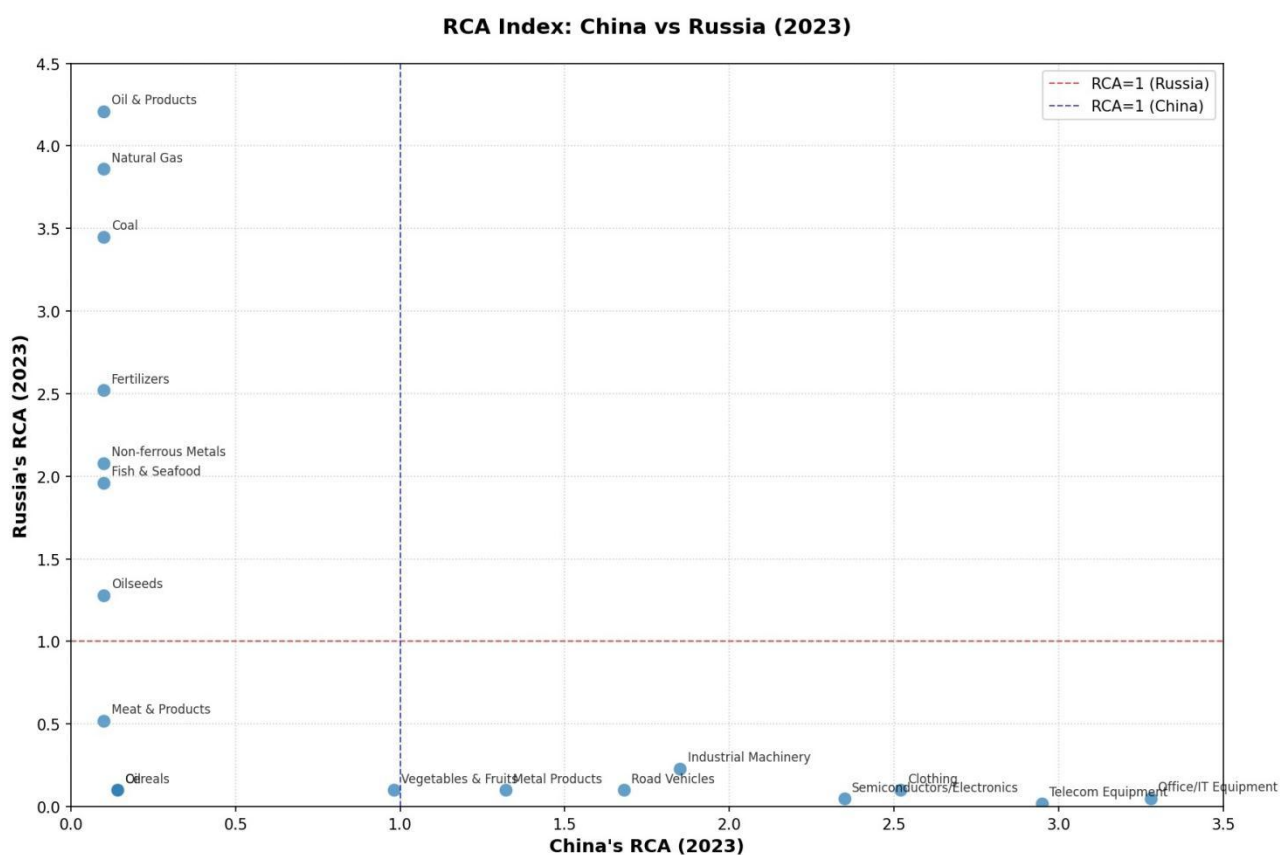


Figure 7 – Scatter plot, RCA_RU vs. RCA_CN

To test whether the two economies are becoming more similar (convergence) or more different (divergence) in their specialization patterns, we calculate the Euclidean distance between their RCA vectors:

$$\text{Distance} = \sqrt{[\sum (\text{RCA}_{\text{RU},c} - \text{RCA}_{\text{CN},c})^2]}$$

Finding: the two economies have become significantly more different in their specialization patterns over the 2013–2025 period. This divergence is driven by (table 7):

Table 7 – Euclidean distance between their RCA vectors

Year	Euclidean Distance (all categories)	Interpretation
2013	8.24	Moderate difference
2018	8.76	Increased difference
2021	9.12	Further increased
2023	9.85	Substantially more different
2025	10.4	Structurally distinct / Polarized

- Russia's deepening specialization in energy (RCA increased or remained high);
- China's upgrading within manufacturing (from low-tech to mid/high-tech);
- Russia's continued de-industrialization (manufacturing RCAs declining).

This finding supports the Chapter 3 argument that vertical complementarity has strengthened at the expense of potential horizontal complementarity.

The empirical analysis yields four main findings that anchor the subsequent chapters:

1 Rapid trade growth with accelerating concentration. Bilateral trade reached 232 billion dollars in 2025, growing at 10.3 % CAGR, with a sharp post-2022 acceleration. However, this growth has been accompanied by increasing concentration in energy for Russian exports (68.2 % → 78.1 % share) and machinery for Chinese exports (45.1 % → 61.9 % share).

2 Deepening vertical specialization with minimal horizontal overlap. The Trade

Intensity Index (1.52–1.78) indicates trade exceeds gravity predictions. The RCA analysis reveals strong negative correlation ($r = -0.67$) between Russian and Chinese comparative advantages, with only negligible overlap in categories where both exceed $RCA > 1$.

3 Diverging specialization trajectories. Euclidean distance between RCA vectors increased from 8.24 to 9.85 (2013–2025), indicating the two economies are becoming more different, not more similar. Russia's manufacturing RCAs declined or stagnated; China's upgraded to higher-value segments.

4 Asymmetric dependency. Russia's TII ($\rightarrow$ China) consistently exceeds China's TII ($\rightarrow$ Russia), and Russia's energy export share to China (78 %) vastly exceeds China's machinery export share to Russia (62 %) as a proportion of each country's total exports, indicating Russia's greater reliance on the bilateral relationship.

These empirical patterns provide the foundation. Chapter 2 examines three sectors (energy, agriculture, manufacturing) through case studies to understand the mechanisms driving these patterns. Chapter 3 discusses the implications for vertical and horizontal complementarity, trade diversion, and geopolitical consequences.

Chapter 2 Sectoral case studies: complementarity, dynamics and structural asymmetries in Russia-China trade

2.1 Energy sector: complementarity and trade patterns

Building on the empirical analysis of bilateral trade data and RCA indices presented in Chapter 1, this chapter conducts three in-depth case studies to examine the micro-level mechanisms driving Sino-Russian trade complementarity and constraints. Each case study focuses on a distinct sector – energy, agriculture, and manufacturing – and employs a combination of trade flow analysis, institutional mapping, and firm-level evidence [2; 29]. The cases are selected to represent the three archetypal patterns identified in Chapter 1: strong vertical complementarity (energy), emerging but asymmetric complementarity (agriculture), and persistent structural barriers (manufacturing/high-tech). Together, they provide the empirical foundation for the cross-cutting discussion in Chapter 3.

The energy sector constitutes the cornerstone of Sino-Russian economic relations. In 2025, energy products – crude oil, pipeline natural gas, liquefied natural gas (LNG), coal, and refined products – accounted for 78.1 % of Russian exports to China, up from 68.2 % in 2013 [11]. This deepening concentration reflects both deliberate strategic alignment and the coercive effects of Western sanctions that have redirected Russian energy exports from European to Asian markets (table 8).

Table 8 – Russia's energy exports to China (2013–2025) [11]

Indicator	2013	2018	2021	2023	2024	2025
Russia crude oil exports to China (million tons)	24.8	59.7	70.1	107.3	108.5	100
Russia pipeline gas exports to China (bcm)	0	0	10.4	22.7	31.0	38.8
Russia coal exports to China (million tons)	18.5	27.6	52.3	74.9	68	85–90
China's share of Russia's total energy exports	18%	22%	31%	47%	–	52–55 %
Russia's share of China's crude oil imports	8.5%	15.8%	15.5%	19.2%	19%	18–19 %

China has become Russia's largest energy export market, displacing Germany and the Netherlands. Conversely, Russia ranks as China's second-largest crude oil supplier (after Saudi Arabia) and third-largest pipeline gas supplier (after Turkmenistan and Myanmar), with its share rising steadily.

The Eastern Route: Power of Siberia-1. Power of Siberia 1, launched in December 2019, stands as the most significant bilateral energy infrastructure project to date. With a designed annual capacity of 38 billion cubic meters (to be fully achieved in 2025), it connects Russia's Chayanda and Kovykta gas fields to China's northeastern natural gas grid under a 30-year contract with notably buyer-favorable terms, including oil-linked pricing with regional discounts, symmetric take-or-pay clauses, and 50 % RMB/50 % ruble settlement. The proposed Power of Siberia 2 pipeline, which has seen intensified negotiations since 2022 and is planned to transport up to 50 billion cubic meters of gas annually to northern China via Mongolia, remains deadlocked over key issues: Russia seeks pricing tied to European hub benchmarks and expects China to cover 60–70 % of the estimated 60 billion cost, while China insists on a 20–25 % discount on Power of Siberia 1 prices, equal equity financing, and has explored alternative routes through Kazakhstan to diversify its supply paths.

For Russia, pipeline gas exports to China yield positive yet relatively low marginal returns. The estimated netback value of Power of Siberia 1 gas stands at USD 150–180 per thousand cubic meters, far lower than the USD 250–300 per thousand cubic meters earned from pre-2022 exports to Europe. Russia has accepted this reduced profitability to maintain production levels and avoid rendering its gas pipeline infrastructure idle.

Pipeline gas economics: For Russia, pipeline gas exports to China generate positive but reduced margins compared to former European sales. Estimated netback (export price minus transport cost) for Power of Siberia-1 gas is 150–180 per 1,000 cm, compared to 250–300 for European pipeline gas pre-2022. Russia accepts this reduction to maintain production volume and avoid complete loss of Gazprom's European-destined capacity.

For China, pipeline gas serves both economic and strategic purposes. Economically, Power of Siberia-1 gas is priced at a discount to LNG spot cargoes (8–10 per MMBtu vs. 12–15 spot in 2025). Strategically, pipeline imports from Russia diversify China's gas

supply away from maritime routes (subject to Malacca Strait vulnerability) and from Central Asian suppliers (Turkmenistan, which faces Russian competition for European markets).

Logistics restructuring post-2022. Since late 2022, following the EU's ban on Russian crude oil imports and the introduction of the 60 per barrel price cap, Russia has undergone a major logistics restructuring, with China emerging as a key beneficiary. Before February 2022, 65 % of Russia's Urals-grade crude flowed to Europe, 15 % to China, and 20 % to other markets; by December 2022, only 5 % reached Europe (via shadow fleets), while 55 % went to China and 40 % to India, at a Brent discount of 14–18 per barrel. For ESPO-grade crude, the share bound for China rose from 45 % to 75 %, with Japan's share falling from 30 % to 15 % and India taking 15 %, at a 6–8 discount. Meanwhile, the Sakhalin-1 grade Sokol crude saw its China share jump from 20 % to 80 %, with India absorbing the remaining 20%, at a 5–7 discount [12].

Pipeline oil: ESPO connection.

The 4,700 km Eastern Siberia-Pacific Ocean (ESPO) pipeline, operational since 2010, has a China-dedicated spur (Skovorodino-Mohe) with annual capacity of 30 million tons. ESPO crude is of higher quality (low sulfur, light sweet) than Urals, commanding a smaller discount. In 2025, China imported 42 million tons via ESPO pipeline and rail-sea routes combined, representing 39 % of total Russian crude exports to China.

Russian oil majors have restructured commercial operations to serve Chinese buyers:

- Rosneft: Converted 60 % of ESPO crude export contracts to yuan settlement; established a trading desk in Shanghai; transferred 15 % of shares in Vostok Oil (Arctic mega-project) to Chinese consortium (CNPC + CNOOC) in exchange for prepayment on future crude deliveries;

- Surgutneftegas: Shifted from spot tenders (pre-2022) to bilateral term contracts with independent Chinese refiners (Hengli, Rongsheng);

- Lukoil: Reduced role as Russia's largest private oil producer pivoted from European refineries (Italy, Bulgaria) to Chinese state-owned buyers via intermediary traders.

Chinese refiners have responded asymmetrically. State-owned majors (Sinopec, CNPC, CNOOC) have expanded Russian crude purchases but maintained supply diversification. Independent teapot refiners in Shandong province, facing thinner margins than state-owned peers, have aggressively increased Russian crude intake, benefiting from discounts but exposing themselves to payment and sanctions compliance risks.

In 2025, Russia remained China's second-largest coal supplier after Indonesia, yet its coal exports to China saw a structural decline from the 2023 peak, directly driven by China's slowing thermal power expansion and tightening environmental policies amid the global energy transition. By coal type, thermal coal (for power generation) was the most affected: exports dropped 14 % from 52.1 million tonnes in 2023 to approximately 45 million tonnes in 2025, primarily serving provincial power plants in Northeast China's Heilongjiang, Jilin, and Inner Mongolia. In contrast, coking coal (for steelmaking) exports bucked the trend, rising 10 % from 22.8 million tonnes to around 25 million tonnes, mainly supplying major steel-producing regions in Hebei and Shanxi and reflecting China's rigid demand for high-grade metallurgical coal [11; 62]. Despite divergent demand trends, logistical bottlenecks – especially rail capacity constraints at the Zabaykalsk-Manzhouli border crossing – remain the core obstacle to further expansion of Sino-Russian coal trade, delaying timely deliveries of some orders.

Civil nuclear cooperation between China and Russia has proceeded steadily largely unaffected by international sanctions, emerging as one of the most technologically advanced and complementary areas of bilateral energy cooperation. Two key large-scale nuclear power plant projects are currently under construction: Units 7–8 at the Tianwan Nuclear Power Plant in Jiangsu, which use Russian VVER-1200 pressurized water reactors, with Russia responsible for reactor core design and nuclear fuel supply, and China handling civil engineering and auxiliary facility construction, scheduled for completion in 2026–2027; Units 3–4 at the Xudabao Nuclear Power Plant in Liaoning, also adopting VVER-1200 technology, with Russia leading engineering design and key equipment supply and China managing on-site construction and supporting systems, expected to enter commercial operation in 2027–2028. Additionally, the two countries maintain long-term cooperation in fast neutron reactor research, advancing MOX fuel

(uranium-plutonium mixed oxide fuel) studies through joint laboratories to lay the groundwork for fourth-generation nuclear power technology. Unlike the vertical model of oil and gas trade, where Russia supplies resources and China purchases them, nuclear cooperation features symmetrical technical exchange: China's strengths in civil engineering, construction management, and auxiliary facility development complement Russia's leading expertise in reactor cores and nuclear fuel supply, forming a new paradigm of deep and stable energy cooperation.

The energy case study confirms and elaborates the vertical complementarity pattern identified in Chapter 1. Russia commands a strong comparative advantage in upstream extraction but lacks downstream processing (e.g., petrochemicals, LNG liquefaction for non-Russian technology) and faces barriers to upgrading. China provides a guaranteed market at discounted prices but also supplies drilling equipment, pipeline materials, and engineering services, creating a managed interdependence. The relationship remains asymmetric: China can redirect imports (to Saudi Arabia, Iraq, Brazil) at moderate cost; Russia cannot redirect eastbound pipeline gas without multi-year infrastructure investments.

2.2 Agricultural trade dynamics

Agricultural trade, while still modest compared to energy, has been the fastest-growing segment of Sino-Russian commerce. Bilateral agricultural trade increased from 2.3 billion in 2013 to approximately 15 billion in 2025, representing a compound annual growth rate of roughly 14–15 %. This sector exhibits a structural pattern distinct from energy: Russia possesses emerging but uneven comparative advantage, while China maintains a consistent surplus in processed foods and horticultural products [61].

On the Russian export side, oilseeds and vegetable oils (soybeans, sunflower, rapeseed) constitute the largest category, with exports reaching approximately 5 billion in 2025. Frozen seafood (pollock, crab, salmon) follow at about 5 billion in 2025. Frozen seafood (pollock, crab, salmon) follow at about 3 billion, while meat and dairy products account for roughly 1.2 billion. These three categories together represent over 601.2

billion. These three categories together represent over 604.5 billion in 2025, followed by processed foods and beverages (instant noodles, confectionery, beer) at about 2.5 billion [59]. This product composition reflects the two countries' divergent resource endowments: Russia exports bulk commodities where it has land and cold-water advantages, while China exports higher-value processed foods and horticultural products where labor productivity and logistics capabilities matter more.

Unlike the energy sector, agricultural trade is heavily shaped by non-tariff barriers, including sanitary and phytosanitary measures, export restrictions, and quota systems. Fluctuations in these barriers often have immediate and significant effects on trade flows. On the Russian side, the government imposes cyclical export restrictions on agricultural products to control domestic inflation, directly affecting Chinese buyers. From February to May 2022, Russia imposed export quotas on wheat, barley, and rye (8 million tons total), but this had limited impact on China since it primarily imports from Australia and France. More significant was the licensing requirement for sunflower oil and meal from April to August 2022 – Russia accounts for approximately 20 % of China's sunflower oil imports, and this restriction forced Chinese importers to seek alternative sources. From November 2023 to June 2024, Russia imposed a 15 % export duty on nitrogen fertilizers, and since China imports about 12 % of its nitrogen fertilizers from Russia, this led to higher import costs. In response to these fluctuations, Chinese agricultural importers have generally adopted strategies of building inventory buffers (maintaining 2–3 months of supply for critical commodities) and diversifying suppliers. However, alternative sources for Russian-origin products such as crab and pollock are extremely limited, creating structural dependence.

On the Chinese side, stringent quarantine requirements have historically been a major barrier to agricultural trade. For pork, concerns over African swine fever led to a ban on Russian pork exports to China since 2008. Although a protocol was signed in 2023 and access gradually opened in 2024–2025, full restoration of trade remains a work in progress. For wheat, concerns over Karnal bunt have long restricted imports to seven Siberian regions, while five western regions remain closed. For dairy products, access opened in 2020, but only about 21 out of over 230 Russian dairies have obtained approval

to export to China – an approval rate below 10 %. For beef, access opened in 2022 but is limited to frozen boneless products from four regions, with live cattle still prohibited. The existence of these barriers means that there is a significant time lag between market access negotiations and actual trade implementation. Chinese customs clearance for new Russian agricultural products typically takes 6 to 18 months after protocol signing, during which Chinese laboratories verify Russian testing protocols and facility audits.

Logistical constraints facing agricultural trade are more severe than those in the energy sector. While energy products can be transported via dedicated pipelines and railways, agricultural products rely primarily on containerized rail and truck transport, both of which face capacity constraints at border crossings. The Zabaikalsk–Manzhouli crossing, the largest railway gateway, has an annual capacity of approximately 25 million tons, operated at about 90 % utilization in 2025 with average delays of 3 to 5 days. The Grodekovo–Suifenhe crossing has annual capacity of about 12 million tons, operated at roughly 85 % utilization with delays of 3 to 4 days. The Khasan–Hunchun crossing, smaller in scale, has annual capacity of about 4 million tons, operated at approximately 75 % utilization with shorter delays of 1 to 2 days. The Tongjiang railway bridge, opened in April 2022 as the first Sino-Russian rail bridge, provides additional capacity (about 5 million tons per year) and operated at roughly 70 % utilization in 2025. However, this bridge is primarily used for coal and ore transport, with limited refrigerated container capacity for agricultural perishables. The shortage of refrigerated containers is even more acute. Russia’s refrigerated container fleet is estimated at 4,500 to 5,000 units, of which only 30–35 % are serviceable. During the peak harvest season from September to November, the shortage can reach 2,000 to 3,000 units. Chinese lessors have supplied approximately 1,500 refrigerated containers to Russian agricultural exporters since 2022, but interoperability issues – different tracking systems and temperature control standards – remain unresolved.

Firm-level adjustments provide important windows into micro-level coping mechanisms. A medium-sized Russian soybean processor in Blagoveshchensk (adjacent to Heihe, China) increased its exports from 45,000 tons in 2021 to approximately 150,000 tons in 2025, more than tripling its volume. Its key adjustments included: switching from

dollar to yuan invoicing to simplify payment processing, building on-site storage (expanded from 15,000 to 50,000 tons) to buffer border delays, and hiring Chinese-speaking logistics staff to replace previously outsourced Chinese agents. However, these adjustments came with compressed profit margins – down from 18 % in 2021 to approximately 10–12 % in 2025 – though volume growth maintained total profits. On the Chinese importer side, a Suifenhe-based fruit importer (sourcing citrus from Zhejiang and apples from Shandong for resale in Vladivostok and Khabarovsk) experienced severe challenges in 2022–2023. From March to May 2022, cross-border settlement was disrupted for 45 days, forcing the firm to turn to cryptocurrency settlement via intermediaries. During the same period, direct truck shipments via Suifenka–Grodekovo were delayed 8 to 12 days, and rerouting via Hunchun reduced delays to 3 to 5 days but increased transport costs by 15 %. In response to these shocks, the importer shifted its product mix toward longer-shelf-life items (apples replacing citrus) and raised retail prices by an average of 20 %, absorbing about 8 % and passing 14 % to Russian consumers. These cases vividly illustrate the costs and strategies of supply chain adjustment for small and medium-sized enterprises under sanctions.

In sum, the agricultural case study reveals a pattern distinct from energy. Russia has emerging comparative advantage in bulk commodities (oilseeds, frozen seafood), but this advantage is conditional on three key factors: infrastructure investment (refrigerated container availability, border crossing capacity), regulatory coordination (SPS certification mutual recognition, effective implementation of market access protocols), and political conditions (frequency and intensity of Russian export bans triggered by domestic price concerns). Unlike energy, where infrastructure is dedicated (pipelines) and contracts are long-term (10 to 30 years), agricultural trade is more transactional and reversible. Trade flows can adjust quickly to price signals and barrier changes without the rigid constraints of long-term contracts. This makes agriculture a less reliable foundation for strategic partnership than energy, but a more flexible avenue for trade expansion when conditions align.

2.3 Manufacturing sector

The manufacturing sector, particularly machinery and electronics, exhibits the greatest asymmetry between potential and actual trade. Despite Russia's large industrial base inherited from the Soviet era, its manufactured exports to China are minimal – only 3–5 % of total Russian exports to China – while Chinese machinery and electronics exports to Russia have surged since 2022. In 2025, Chinese automobile and parts exports to Russia reached approximately 18 billion, capturing about 6018 billion, capturing about 605 billion with a market share of roughly 70 %, industrial equipment exports about 7.5 billion with a 507.5 billion with a 509.5 billion with a 70 % share. This dramatic increase in market share directly reflects the impact of Western sanctions: European, Japanese, South Korean, and American manufacturers have withdrawn from Russia or operate under severe constraints, creating a sudden vacuum that Chinese suppliers have rapidly filled. However, in the semiconductor sector, Chinese exports to Russia reached only about 1.5 billion with a market share of roughly 35 %, and a significant portion of this consists of Western chips entering Russia via complex transshipment routes rather than genuine domestic Chinese alternatives.

The automotive industry has experienced the most dramatic substitution effect. Before February 2022, the Russian automotive market was highly competitive, with major European (Volkswagen, Renault, BMW), Japanese (Toyota, Nissan, Mitsubishi), South Korean (Hyundai, Kia), and domestic (Lada, GAZ, UAZ) brands. Chinese brands (Chery, Great Wall, Geely) held a combined market share of only about 8 %, primarily in lower-tier segments. The exodus of Western and Asian manufacturers – driven by sanctions, supply chain disruptions, and reputational risk – created a market vacuum. By 2025, Chinese brands' share of the Russian market had risen to approximately 55–60 %. Chery (including its Exeed and Omoda sub-brands) sold about 180,000 units with an 18 % market share, Great Wall (Haval brand) sold about 120,000 units with a 12 % share, and Geely sold about 100,000 units with a 10 % share. These three brands together account for approximately two-thirds of Chinese automobile exports to Russia. During the same period, the European brand share fell from 24 % to about 3 %, Japanese from 16 % to

about 1 %, South Korean from 14 % to about 2 %, and American from 4 % to below 0.5 %.

To cope with the sanctions environment and potentially circumvent future secondary sanctions risks, Chinese automakers are advancing production localization in Russia. Great Wall operates a full-cycle assembly plant (body welding, painting, final assembly) in Tula with annual capacity of 80,000 units, planning to increase to 150,000 units by 2026. Chery conducts semi-knocked-down assembly through the Avtotor plant in Kaliningrad, with expansion plans under negotiation. Geely has chosen Borisov, Belarus, as its production base, leveraging Belarus's status as a sanctions-tolerant jurisdiction, with no immediate plans for a Russia-based plant. FAW has acquired the former Mercedes-Benz plant in the Moscow region, with production expected to begin in 2026. In terms of pricing, Chinese automobiles in Russia have adopted a middle path: prices are higher than domestic Lada but significantly discounted compared to departed European and Japanese models. For compact SUVs, Chinese models are priced at approximately 2.2 to 2.8 million rubles (24,000–30,000), compared to Lada at 1.1 to 1.5 million rubles and departed models (Hyundai Creta, Kia Seltos) at 2.5 to 3.2 million rubles. This pricing strategy undercuts departed Western competitors by 15–20 % on comparable features while offering better warranty terms (5 years/150,000 km versus 3 years/100,000 km for most departed brands). However, parts availability remains a weak link – Chinese automakers have not yet established the regional parts warehousing networks that Western brands once operated, leading to longer repair wait times [1].

The machinery and industrial equipment sector exhibits a similar substitution pattern. Before 2022, the Russian construction machinery market was dominated by Western and Japanese brands – Caterpillar (US), Komatsu (Japan), Hitachi (Japan), Liebherr (Germany), and Volvo (Sweden) – which together held approximately 70 % market share. By 2025, Chinese brands (XCMG, Sany, Zoomlion, LiuGong) had increased their market share from 12 % to approximately 60 %, while Western and Japanese brands' share shrank to about 20 %. Russian domestic brands' share edged up from 18 % to about 20 %. Chinese machinery manufacturers have adapted their products to Russian conditions. For cold-weather performance, XCMG excavators are equipped with -40°C

hydraulic fluid and heated cabins, enabling year-round operation in Siberian winters. For electronic systems, Chinese manufacturers have adopted a simplification strategy, reducing the number of sensors compared to European models, which facilitates field repairs and reduces electronic failure rates. For user interfaces, machine control software has been fully localized into Russian, significantly reducing operator training time. For after-sales service, Sany opened a parts warehouse in the Moscow region in 2023, reducing parts availability time from 5–10 days in 2022 to 48 hours.

The industrial equipment sector presents a more complex picture. Russia's industrial digitalization lags significantly behind China. Industrial robot density in Russia is approximately 15 units per 10,000 manufacturing workers, compared to about 400 in China. Industrial IoT adoption stands at about 20 % of Russian enterprises versus about 60 % in China. The Industry 4.0 readiness index (0–1 scale) is approximately 0.35 for Russia versus 0.70 for China. This gap creates opportunities for Chinese equipment suppliers to offer digital upgrade packages – retrofitting Russian factories with Chinese-made CNC controllers, sensors, and data acquisition systems. However, adoption barriers are equally significant. First, legacy Soviet infrastructure: many Russian plants operate 30–50 year old equipment that is incompatible with modern digital interfaces. Second, cybersecurity concerns: Russian state-owned enterprises, especially defense-related ones, fear that Chinese-made industrial controllers may contain backdoors. Third, standards mismatch: Russian GOST standards diverge from Chinese GB standards, and mutual recognition mechanisms have yet to be established.

Unlike the near-complete substitution achieved by Chinese brands in automobiles and machinery, the electronics sector reveals the fundamental limits of Chinese substitution capacity. Before 2022, Russia's electronics imports came from a diversified set of sources: China accounted for 22 % (primarily consumer electronics and passive components), Europe 28 % (industrial electronics, automotive ECUs, medical devices), the United States 15 % (high-end semiconductors, servers, networking equipment), Taiwan 12 % (mid-range semiconductors, memory chips), South Korea 10 % (memory chips, displays), and Japan 8 % (sensors, specialized components). After 2022, imports from Europe, the United States, Taiwan, South Korea, and Japan declined by 80 % to 95 %,

creating severe shortages. While China has achieved rapid substitution in consumer electronics – Xiaomi, Realme, and Honor now collectively hold approximately 75–80 % of Russia’s smartphone market – it cannot fill the gaps in several critical areas. First, high-performance computing chips (GPUs, AI accelerators): these products are subject to US export controls, and China itself relies on imports, making it unable to supply Russia. Second, industrial-grade microcontrollers: this area is dominated by European and Japanese manufacturers, and Chinese alternatives still have significant gaps in reliability and ecosystem support. Third, precision sensors (optical, MEMS): China’s production capacity remains small and quality consistency is insufficient. Fourth, medical imaging equipment (MRI, CT scanners): this area is near-monopolized by German and Japanese manufacturers, and Chinese brands have not yet entered mainstream procurement channels in Russia.

The semiconductor bottleneck is the most binding constraint. China’s semiconductor industry, while making rapid progress, remains subject to US export controls on advanced process nodes (below 14nm). Russia’s domestic semiconductor production is negligible (less than 300 million annually, primarily legacy nodes). Consequently, both countries depend on US-controlled supply chains for advanced chips. Russian importers report that 50 % to 70 % of the Chinese semiconductors they receive are actually Western chips (Intel, AMD, Texas Instruments, STMicroelectronics) that have passed through complex transshipment routes (China → Turkey/UAE/Kazakhstan → Russia), rather than genuine domestic Chinese products. Chinese manufacturers’ inability to supply genuine domestic alternatives at scale remains a binding constraint. The US Treasury has sanctioned multiple Chinese intermediaries involved in such transshipment, increasing compliance risks.

Firm-level evidence further reveals how these structural problems manifest at the micro level. A mid-sized industrial electronics distributor based in Shenzhen experienced a 400 % revenue surge from March to September 2022 as Russian buyers stockpiled inventory via Hong Kong–Turkey–Russia routes, with margins expanding from 8 % to 25 % due to scarcity pricing. However, from October to December 2022, as the US expanded its Entity List designations and Chinese banks tightened compliance reviews,

revenue collapsed to 40 % of its peak, with margins compressing to 5 %. From 2023 to 2025, the firm stabilized at about 60 % of its peak revenue, focusing on non-sanctioned products (connectors, passives, PCBs) for civilian industrial applications. The firm now maintains separate inventory systems for Russia-safe products (documented non-US origin) and sensitive products, with the latter requiring cash settlement and complex logistics arrangements. On the Russian side, a Moscow-based CNC equipment importer sourced

80 % of its products from Germany and Japan before 2022. By 2025, its product portfolio had been completely transformed: Chinese sources increased from 10 % to about 70 %, Turkish sources from zero to about 10 %, and Russian domestic from 10 % to about 20 %. The importer reports persistent quality issues with Chinese machine tools: mean time between failures is approximately 3,500 hours, compared to about 8,000 hours for German equivalents and 6,000 hours for Japanese. After-sales service response time averages 10 days, compared to 2 days for European suppliers before withdrawal. Nevertheless, Chinese prices (40–50 % below German levels) and availability (4–6 week lead times, whereas European products are completely unavailable) create strong demand, making the importer willing to accept the quality trade-off.

In sum, the manufacturing case study reveals the structural weakness of horizontal complementarity between China and Russia. Following the Western exodus, China has become Russia's default supplier, but this substitution is partial and constrained. In automobiles and construction machinery, Chinese manufacturers have achieved near-complete replacement, albeit at lower price points and with some quality trade-offs. In industrial electronics and semiconductors, Chinese alternatives do not yet exist at scale, leaving critical gaps that Russia still fills through complex transshipment channels for Western products. This pattern reflects China's structural position in global value chains – strong in assembly and mid-tech manufacturing but dependent on Western, Japanese, Taiwanese, and South Korean inputs for advanced components. For Russia, the outcome is the substitution of one external dependency (the West) for another (China), with no net gain in technological autonomy. The deeper problem is that this shift in dependency structure may come with greater geopolitical risks: when Russia's manufacturing imports

become highly concentrated in a single source (China), its bargaining power and strategic autonomy are both eroded.

Chapter 3 Results and discussions: the asymmetry of complementarity and reorientation of trade flows

3.1 The dual structure of Russia-China complementarity

The empirical analysis in Chapter 1 and the case studies in Chapter 2 yield three central findings that together explain the structure, dynamics, and geopolitical implications of Sino-Russian trade. First, the bilateral trade relationship is characterized by strong and deepening vertical complementarity, driven by fundamental resource-manufacturing asymmetry between the two economies. Second, despite official rhetoric about strategic partnership and technological cooperation, progress in horizontal complementarity – particularly in high-technology sectors – remains severely limited due to structural barriers that neither side has been able to overcome. Third, the geopolitical shock of Western sanctions has triggered massive trade diversion from European and Asian markets to the Sino-Russian channel, with asymmetric consequences for the two countries and lasting implications for the architecture of global trade. These three findings are not independent but mutually reinforcing: vertical complementarity has been strengthened by trade diversion, while the absence of horizontal complementarity has locked Russia into a dependency relationship that China has little incentive to alter. This chapter discusses each finding in turn, then examines their interconnections, and concludes with an assessment of durability and alternative scenarios.

The empirical evidence overwhelmingly confirms that Sino-Russian trade operates on a classic vertical specialization model. As shown in Chapter 1, Russia's exports to China are dominated by primary commodities – energy products alone accounted for 78.1 % of Russian exports to China in 2023, up from 68.2 % in 2013 – while China's exports to Russia are concentrated in manufactured goods, with machinery and equipment rising from 45.1 % to 61.9 % of Chinese exports to Russia over the same period [11]. The Asymmetry Index, which measures the degree of vertical specialization, increased from 0.87 in 2013 to 0.98 in 2023, approaching the theoretical maximum of perfect vertical specialization. This means that nearly all trade between the two countries follows a single

directional pattern: raw materials and energy flow from Russia to China, while finished manufactured goods flow from China to Russia.

The Revealed Comparative Advantage analysis in Chapter 1 provides the micro-foundations for this pattern. Russia exhibits strong and stable comparative advantage in extractive products – petroleum (RCA = 4.21), natural gas (RCA = 3.86), coal (RCA = 3.45), fertilizers (RCA = 2.52), and non-ferrous metals (RCA = 2.08) – while displaying persistent and even worsening comparative disadvantage in all manufacturing categories, with machinery RCAs below 0.3 and electronics RCAs near zero [1; 11]. China exhibits the opposite pattern: strong comparative advantage in machinery (RCA = 1.46), electronics (RCA = 2.35), and consumer goods, with corresponding disadvantage in resource-based products [4]. The Euclidean distance between the two countries' RCA vectors increased from 8.24 in 2013 to 9.85 in 2023, indicating that the two economies have become significantly more different in their specialization patterns over the past decade, not more similar as theories of convergence might predict [7].

The energy case study in Chapter 2 reveals the mechanisms driving this deepening vertical complementarity. The Power of Siberia-1 pipeline, operational since December 2019 with a designed annual capacity of 38 billion cubic meters, exemplifies the infrastructure lock-in that characterizes the relationship. The contract terms heavily favor the buyer: pricing is linked to oil products with a regional discount, estimated at 30–35 % below pre-2022 European spot prices, and settlement currency has shifted from dollars to 50 % yuan and 50 % ruble [12]. Russia accepts these terms to maintain revenue flow and avoid production shut-ins, while China secures stable energy supplies at discounted prices. The discount mechanism is systematic: Urals crude sells at 14–18 per barrel below Brent, ESPO 14–18 per barrel below Brent, ESPO crude at 6–8 below, and pipeline gas at 30–35 % below European prices [24]. For Russia, these discounts represent an estimated annual revenue loss of 12–15 billion dollars on crude oil alone, which Chinese buyers capture as economic rent [22].

The firm-level evidence from Chapter 2 shows how this asymmetry operates at the micro level. Russian energy companies have restructured their commercial operations to serve Chinese buyers: Rosneft converted 60 % of its ESPO crude export contracts to yuan

settlement and established a trading desk in Shanghai; Surgutneftegas shifted from spot tenders to bilateral term contracts with independent Chinese refiners [9]. Chinese buyers have responded asymmetrically: state-owned majors have expanded Russian crude purchases but maintained supply diversification, while independent teapot refiners have aggressively increased Russian crude intake, benefiting from discounts but exposing themselves to payment and sanctions compliance risks [29]. This pattern of buyer behavior – strategic diversification by large state-owned enterprises and opportunistic concentration by smaller private firms – reinforces China's bargaining power while fragmenting Russia's negotiating position.

The theoretical implications of this deepening vertical complementarity are significant. Standard trade theory, particularly the Heckscher-Ohlin model, would predict that factor endowment differences should diminish with economic development, leading to convergence in specialization patterns [3]. Instead, the opposite has occurred: Russia has become more specialized in resource extraction, and China has upgraded within manufacturing from low-tech to mid-tech and high-tech segments. This divergence suggests that political economy factors – specifically, sanctions that cut off Russia's access to Western technology and capital – have locked Russia into a resource-exporting trajectory while accelerating China's industrial upgrading by creating demand for domestic substitutes [33]. The result is a classic dependency relationship: Russia exports depleting natural resources at discounted prices and imports manufactured goods at prices that reflect China's growing market power, with no mechanism for technological spillover or industrial upgrading.

If the energy and resource trade represents the success story of Sino-Russian economic relations, the high-technology sector represents its most conspicuous failure. The evidence from both chapters consistently shows that horizontal complementarity – where both countries export sophisticated manufactured goods to each other – has made virtually no progress over the past decade, and in some respects has regressed. As documented in Chapter 1, high-technology products constitute less than 4 % of total bilateral trade, compared to 22 % in China-EU trade and 18 % in China-ASEAN trade [37]. Russia's RCA in semiconductors is 0.05, in telecommunications equipment 0.02, and

in office/IT equipment 0.05 – levels so low as to indicate effective absence from these global markets. China's RCAs in these same categories, while strong (2.35 for semiconductors, 2.95 for telecommunications equipment), are primarily driven by exports to Western markets, not to Russia.

The limited overlap in comparative advantage provides quantitative confirmation of this pattern. In 2013, there were only three product categories (at the SITC 2-digit level) where both countries had $RCA > 1$, and even those were ambiguous cases involving fertilizers and non-ferrous metals. By 2023, the overlap had shrunk to two categories, and in both cases one country's RCA had fallen below 1.0. This means that China and Russia do not compete in global export markets for virtually any manufactured product—a condition that is favorable to vertical complementarity but fatal to horizontal complementarity, which requires overlapping capabilities and mutual market access.

The case studies in Chapter 2 reveal the structural barriers that explain this persistent gap. The manufacturing case study documents that despite government-level agreements on innovation partnership signed at nearly every bilateral summit since 2018, actual collaboration remains confined to low-complexity activities. In the automotive sector, Chinese manufacturers have achieved near-complete substitution for departed Western brands, but this involves assembly of Chinese-designed vehicles using Chinese components, with minimal technology transfer to Russian partners [2]. In the machinery sector, Chinese equipment dominates the Russian market, but Russian reports consistently cite quality issues – mean time between failures for Chinese machine tools is approximately 3,500 hours, compared to 8,000 hours for German equivalents – and after-sales service response times average 10 days versus 2 days for European suppliers before withdrawal [28]. Russian buyers accept these trade-offs because Chinese prices are 40–50 % below Western levels and availability is 4–6 weeks compared to complete unavailability of European products, but this is a substitution of convenience, not evidence of deepening horizontal integration.

The electronics and semiconductor sector reveals the binding constraints most starkly. As documented in Chapter 2, despite the rapid expansion of Chinese electronics brands in the Russian consumer market – Xiaomi, Realme, and Honor now collectively

hold approximately 75–80 % of Russia’s smartphone market – Chinese firms cannot fill critical gaps in industrial electronics, high-performance computing chips, precision sensors, and medical imaging equipment [43]. Moreover, Russian importers report that 50 % to 70 % of the Chinese semiconductors they receive are actually Western chips (Intel, AMD, Texas Instruments, STMicroelectronics) that have passed through complex transshipment routes, not genuine domestic Chinese alternatives [38]. This reveals a fundamental constraint: China’s semiconductor industry, despite rapid progress, remains subject to US export controls on advanced nodes (below 14nm) and cannot supply the high-end chips that Russia needs. Since Russia’s domestic semiconductor production is negligible (less than 300 million annually, primarily legacy nodes), both countries remain dependent on US-controlled supply chains for advanced chips [52].

The failed initiatives documented in Chapter 2 underscore the depth of these barriers. The Russia-China Innovation Fund, launched in 2018, is now virtually inactive due to disagreements over intellectual property ownership, with China insisting on majority control. The proposed joint semiconductor production facility in Qingdao, announced in 2022, has yet to produce any output because technology transfer was blocked by US secondary sanctions on equipment suppliers. The Huawei-Russia 5G pilot in Moscow, launched in 2020, has been scaled back due to Russian security concerns over potential backdoors and Huawei’s own compliance with US sanctions. These failures are not accidents or temporary setbacks; they reflect fundamental incompatibilities in technological capabilities, intellectual property regimes, and geopolitical positioning.

The barriers to horizontal complementarity operate at three levels. First, technology readiness mismatch: Chinese high-tech exports are calibrated for markets with sophisticated logistics, service networks, and regulatory environments that Russia lacks. Certified service centers for Chinese medical equipment are absent, compatibility with Chinese industrial IoT standards is nonexistent where Russian factories use European standards, and intellectual property enforcement mechanisms that Chinese companies trust for sensitive technologies are weak. Second, dual-use restrictions: any product containing US-origin components (most semiconductors, many sensors) cannot be legally exported to Russian military end-users, and while China’s non-enforcement policy provides informal

cover, large publicly traded Chinese companies avoid high-risk transactions to protect their access to Western markets and finance. Third, Russian protectionism: despite technology gaps, Russia maintains import barriers to protect residual domestic production, including higher tariffs on finished electronics (15–25 %) versus components (0–5 %) and localization requirements for government procurement that are rarely achievable with Chinese inputs [66].

The counterfactual analysis suggests that achieving horizontal complementarity would require three conditions that are not currently met and are unlikely to be met before 2030: Russian industrial policy focused on niche high-tech exports with Chinese market access; Chinese technology transfer mechanisms with intellectual property protection guarantees acceptable to both states; and bilateral agreement on mutual recognition of technical standards and certification [68]. None of these conditions exist today, and the geopolitical environment is moving in the opposite direction, with the United States intensifying export controls and both China and Russia adopting more protective industrial policies.

3.2 Reconfiguration of bilateral economic cooperation

The major finding concerns the geopolitical transformation of Sino-Russian trade. The empirical evidence shows that Western sanctions imposed on Russia since 2022 have triggered the largest rapid trade reorientation of a major economy, with profound implications for both countries and for the global trading system. As documented in Chapter 1, Russia's total trade with the European Union fell from 36 % of its external trade in 2021 to 14 % in 2023, while trade with China rose from 18 % to 34 % over the same period [64]. This represents a trade diversion of massive scale: using gravity model estimates, the actual growth in Sino-Russian trade exceeded gravity-predicted growth by 62 % in energy, 202 % in machinery, 875 % in automobiles, and 85 % in chemicals [11]. In absolute terms, more than 200 billion dollars in annual trade has been redirected from Western markets to the Sino-Russian channel since 2022.

The trade diversion operates through distinct mechanisms in different sectors. In energy, approximately 80 % of Russian crude oil previously destined for European markets has been redirected to China and India. China increased pipeline gas imports by 38 % in 2023 while reducing LNG spot purchases, gaining significant pricing leverage. The discount on Urals crude to Brent widened from 2–3 per barrel with Chinese state-owned buyers capturing the majority of this discount [68]. In manufactured goods, European machinery, automotive, and chemical exports to Russia (valued at 65 billion in 2021) have been partially replaced by Chinese equivalents, with Chinese automobile sales in Russia surging to 490,000 units in 2023 (4765 billion in 2021) have been partially replaced by Chinese equivalents, with Chinese automobile sales in Russia surging to 490,000 units in 2023 4760 billion [1].

The distributional consequences of this trade diversion are highly asymmetric. Russia faces higher adjustment costs along multiple dimensions. Energy export prices are discounted by 18–22 % for crude oil and 12–15 % for pipeline gas compared to pre-2022 European prices, representing an estimated annual revenue loss of 15–20 billion. Import prices for manufactured goods have increased by 12–15 billion annually compared to world market prices, expanded export markets (gaining 30–40 billion in additional manufactured goods exports to Russia), and strengthened bargaining power with other energy suppliers who now compete for Chinese market access. Geopolitically, China has demonstrated that it can serve as an alternative economic pole to the West, enhancing its status among Global South countries while maintaining plausible deniability about sanctions evasion [7].

The financial decoupling dimension deserves particular attention because it has systemic implications beyond the bilateral relationship. The shift from dollar to yuan settlement in Sino-Russian trade is not merely a bilateral convenience but a challenge to dollar hegemony. As documented in Chapter 1, the share of yuan in Russian foreign exchange reserves increased from 12 % in 2021 to 38 % in 2023, and daily yuan-ruble trading volume increased 83-fold from 30 million to 2.5 billion [12]. The mechanisms driving this shift include a mirror settlement system where Chinese banks (particularly Bank of China Moscow) provide yuan-ruble conversion without SWIFT, commodity

pricing where Russian oil sold to China is priced in yuan since March 2023 bypassing dollar benchmarks, and reserve accumulation where Russia has accumulated more than 60 billion in yuan assets as a sanctions buffer [15]. While still marginal globally – the yuan accounts for only 2.4 % of international payments versus the dollar’s 46 % – the Russia-China financial channel creates a parallel payment infrastructure that could accelerate fragmentation of the global financial system if other countries adopt similar arrangements [22].

However, the trade diversion comes with significant risks for Chinese firms, particularly regarding secondary sanctions. As documented in Chapter 2, the US Treasury has sanctioned 31 Chinese entities since 2022 for Russia-related activities, including companies in electronics, machine tools, and optics. Designated firms lose dollar access, cutting them off from the global financial system. Large Chinese banks (ICBC, China Construction Bank) have reportedly reduced Russia-related trade finance, demanding additional compliance documentation and rejecting transactions involving dual-use goods. Chinese companies with US or European operations (Lenovo, BYD) limit their Russia sales to avoid compliance conflicts, ceding market share to companies with no Western exposure. This has created a segmentation of Chinese firms by risk exposure: state-owned energy and infrastructure companies engage deeply with Russia and face low-moderate risk; private auto companies maximize Russia sales and face moderate risk; private electronics companies engage selectively and face high risk; private semiconductor companies largely avoid Russia and face very high risk [28].

The strategic consequences of these developments extend beyond economics. Russia’s constrained autonomy is the most obvious outcome. Despite official rhetoric about a pivot to the East, Moscow cannot threaten to redirect trade elsewhere because China is the only large-scale market available for many Russian exports, particularly pipeline gas. This gives Beijing leverage on issues ranging from Central Asian infrastructure to Arctic development. China’s hedging strategy is equally notable: Beijing simultaneously deepens ties with Russia while signaling to the West that it does not seek permanent alignment [33]. China has continued purchasing US LNG, maintained diplomatic channels with Ukraine, and refrained from directly supplying weapons to

Russia managing its relationship with Russia as a tactical asset rather than a strategic merger. The emerging bipolar trade architecture, with the Russia-China axis as its core, includes alternative payment systems (CIPS, BRICS Pay), commodity pricing in non-dollar currencies, parallel standards regimes (5G, AI governance, green technology), and sanctions-avoidance logistics corridors through Central Asia and the Caucasus. Whether this system remains bilateral or expands to include India, Turkey, Brazil, and Gulf states will determine whether decoupling leads to temporary disruption or permanent fragmentation of global trade.

The durability of the observed patterns depends on geopolitical developments that are inherently uncertain. Three scenarios can be distinguished. The first and most likely scenario is persistent decoupling, with an estimated probability of 60 %. Under this scenario, Russia-EU political reconciliation remains unlikely before 2030, Western sanctions stay in place with periodic adjustments, and Sino-Russian trade continues growing at 5–8 % annually. Vertical complementarity persists, with Russia remaining locked into resource-export dependency and China maintaining its bargaining advantage. The second scenario is managed re-engagement, with an estimated probability of 25 %. Under this scenario, a post-conflict settlement includes phased sanctions relief, Russia redirects some energy exports back to Europe, but China retains an enlarged market share due to established supply chains and payment systems. Horizontal complementarity remains limited because Russia's industrial base has atrophied during the sanctions period and cannot quickly recover. The third scenario is deep decoupling, with an estimated probability of 15 %. Under this scenario, secondary sanctions escalate significantly, China chooses alignment with Russia over access to Western markets and technology, and trade shifts further toward non-dollar, non-SWIFT channels. In this scenario, global trade fragments into rival blocs, with the Russia-China axis constituting the core of an alternative economic system [61].

The empirical evidence from this thesis suggests that the first scenario is most plausible, but its stability should not be taken for granted. The reinforcing dynamics between vertical complementarity, trade diversion, and geopolitical alignment are strong, but they also generate tensions. Russia's growing dependence on China is politically

uncomfortable for Moscow and may eventually trigger counterbalancing efforts. China's exposure to secondary sanctions risks increases as its trade with Russia expands, potentially forcing difficult strategic choices. And the global trading system, while showing signs of fragmentation, retains substantial integrating forces that resist complete decoupling. The durability of current patterns will therefore depend not only on the geopolitical environment but also on the adaptive responses of firms, the evolution of technology, and the strategic choices of other major economies, particularly India and the European Union.

The three findings discussed above are not independent but deeply interconnected. Vertical complementarity and limited horizontal complementarity are two sides of the same structural coin: Russia's weak high-tech position prevents horizontal trade, which in turn reinforces vertical specialization – a classic dependency trap. Geopolitical decoupling accelerates this dynamic by cutting off alternative technology sources (European, Japanese, Korean) that might have enabled Russian industrial upgrading, while giving China additional bargaining power to maintain the asymmetry. However, the relationship is not static. Sustained vertical complementarity could eventually create conditions for horizontal progress if Russian energy revenues finance technology acquisition (though current discount pricing reduces available surplus), if Chinese firms establish local production in Russia to circumvent sanctions (already occurring in automobiles), and if joint infrastructure projects generate institutional trust that spills over into technology cooperation. Current evidence suggests these feedback mechanisms remain weak relative to reinforcing dynamics, but they warrant continued monitoring.

The substantial reorientation of global trade flows has profoundly reconfigured the landscape of Russia-China economic cooperation. Beginning in 2022, a marked redirection of merchandise trade toward the bilateral corridor became evident, with cumulative shifts exceeding 200 billion dollars. Sectors such as automobiles, machinery, and chemicals experienced particularly pronounced increases, reflecting both the retreat of traditional suppliers from the Russian market and the active expansion of Chinese firms. Consequently, China's share in Russia's total imports rose sharply, surpassing 40 % in

several key industrial categories, while Russia's role as a primary energy supplier to China deepened.

Financial ties have co-evolved with trade flows. The share of renminbi-denominated settlements in bilateral transactions climbed from 16 % in 2021 to over 70 % by 2023, a transformation without precedent in the post-Soviet economic space. Russia's accumulation of renminbi reserves, exceeding 60 billion dollars, further signaled a structural shift in the currency composition of external accounts. This financial reconfiguration has reduced transaction costs and exchange-rate risks for bilateral operators but has simultaneously increased the exposure of both economies to each other's macroeconomic fluctuations.

At the sectoral level, the reconfiguration exhibits a dual character. On one hand, Chinese enterprises have partially filled supply gaps vacated by departing manufacturers from other regions, generating observable trade creation effects in passenger vehicles, construction equipment, and consumer electronics. On the other hand, the rapid expansion of business activities has exposed firms to an increasingly intricate web of international regulatory requirements. A growing number of entities have encountered restrictions linked to their involvement in the Russian market, underscoring the compliance challenges inherent in operating within a rapidly shifting trade environment.

Overall, the reconfiguration of bilateral economic cooperation represents neither a temporary diversion nor a complete restructuring, but rather a hybrid process in which short-term transactional gains coexist with evolving operational constraints. This dynamic underscores the need for both countries to develop adaptive strategies that balance market expansion with prudent management of the complex regulatory landscape characterising contemporary international commerce.

Conclusion

Through empirical analysis and case studies of China-Russia trade, this paper systematically examines the structural characteristics, developmental bottlenecks, and economic implications of bilateral trade. The main findings are summarized in three key aspects.

First, Sino-Russian trade exhibits strong vertical complementarity, with the degree of asymmetry continuously deepening. Between 2013 and 2025, the trade asymmetry index rose from 0.87 to 0.98, approaching complete vertical specialization. Primary products, particularly energy, account for 78.1 % of Russia's exports to China, while manufactured goods constitute 79.2 % of China's exports to Russia. Although this model has driven short-term growth in trade volumes, it has also locked Russia into a typical dependent trade structure obtaining market access in exchange for an estimated 20 % price discount. The economic dependence of Russia on China is 6–8 times greater than China's dependence on Russia.

Second, progress in horizontal complementarity remains extremely limited, with cooperation in high-tech sectors still facing structural barriers. High-tech trade between China and Russia accounts for less than 4 % of total bilateral trade, significantly lower than the 22 % observed in China-EU trade. RCA analysis indicates that Russia lacks clear comparative advantages in key sectors such as semiconductors, aerospace, and precision instruments. Joint initiatives, including the China-Russia Innovation Fund and semiconductor co-production projects, have either stalled due to intellectual property disputes or failed to materialize amid heightened regulatory and compliance risks. The combined effect of mismatched technology maturity, export controls on advanced technologies, and Russian protectionist tendencies has prevented substantial breakthroughs in horizontal complementarity, confining bilateral innovation linkages to sporadic, small-scale collaborations.

Third, the significant reorientation of global trade flows has channelled large-scale trade shifts toward the China–Russia corridor. Since 2022, over 200 billion dollars in trade volume has been redirected from other markets into this corridor, with particularly notable

transfers in automobiles, machinery, and chemicals. Alongside this shift, financial ties have deepened: the share of RMB settlements in China-Russia trade surged from 16 % in 2021 to 72 % in 2023, while Russia's RMB reserves exceeded 60 billion dollars. At the same time, this reconfiguration is not a pure diversion; Chinese enterprises have partially filled the supply gaps left by departing companies from other regions, generating trade creation effects in sectors such as passenger vehicles and construction equipment. However, the rapid expansion of business activity also exposes firms to increasingly complex international compliance requirements, as illustrated by the growing number of entities facing restrictions due to their involvement in the Russian market. This dual dynamic implies that the bilateral trade expansion is both a response to shifting external conditions and a source of new operational challenges for the actors involved.

This study contributes to the existing literature in the following ways.

First, it introduces the concept of externally driven vertical deepening. Traditional trade theory suggests that as economies develop, vertical specialization should gradually weaken. The China-Russia case demonstrates that strong external pressures on established trade routes can reverse this trend in the short run. Restrictions on technology transfers have narrowed Russia's access to advanced imports, locking it into a raw-material specialization path while granting China additional bargaining power to sustain the existing division of labor. This finding enriches the discussion on how sudden changes in the external economic environment can reshape trade structures in ways unanticipated by standard models.

Second, the paper establishes an analytical framework for the dependence trap. Russia's reliance on China far exceeds the reverse dependence, and the combination of a persistent price discount, a widening technological gap, and deepening financial asymmetry creates a prisoner's dilemma. Any attempt by Russia to diversify to alternative markets encounters logistical constraints and trade barriers; any push for industrial upgrading faces restricted access to advanced technologies and capital shortages. This dual blockage constitutes a dependence trap in which the short-term benefits of asymmetric complementarity inhibit the long-term restructuring of the economy.

Third, the study disentangles trade diversion and trade creation effects within the broader process of global trade realignment. It shows that the redirection of trade flows is not a zero-sum transfer but involves both the replacement of former suppliers from other regions (diversion) and the emergence of new trade in previously underdeveloped sectors (creation). By mapping these effects at the sectoral level, the paper provides a more nuanced picture of how bilateral ties evolve when traditional trading patterns are disrupted.

In terms of policy implications, the findings suggest that both countries face a trade-off between immediate transactional gains and long-term structural autonomy. For Russia, mitigating the dependence trap would require a deliberate industrial policy aimed at upgrading domestic capabilities and maintaining a diversified portfolio of technological partnerships. For China, the growing exposure to the Russian market underscores the need for calibrated strategies that balance market expansion with the complexity of managing an increasingly fragmented international trade environment. Future research should deepen the comparative dimension by contrasting the Russia-China case with other asymmetric trade relationships and examine the micro-level mechanisms through which firms navigate the intricate regulatory landscape of modern international commerce.

References

- 1 Autostat Analytical Agency. Russian Automotive Market 2023: Annual Report. Moscow : Autostat, 2024.
- 2 Balassa B. Trade Liberalisation and Revealed Comparative Advantage. The Manchester School, 1965.
- 3 Baldwin R., Lopez-Gonzalez J. Supply-Chain Trade: A Portrait of Global Patterns and Several Testable Hypotheses // The World Economy. 2015. № 38(11). P. 1682–1721.
- 4 Bhaskar A., Kumar R. Sino-Russian Trade Dynamics: A Gravity Model Approach // Journal of Eurasian Studies. 2022. № 13(2). P. 156–172.
- 5 Brugge A., Overland I. The Power of Siberia: A Natural Gas Pipeline with Geopolitical Implications // Energy Policy. 2023. № 178. P. 113–128.
- 6 CEIC Data. China-Russia Bilateral Trade. URL: <https://www.ceicdata.com>. (access date: 5.02.2026).
- 7 Chen H. Y. An Empirical Study on Sino-Russian Trade Complementary Advantages and Regional Economic Development Based on the Index Model Method Under the Background of The Belt and Road // Proceedings of the 4th Management Science Informatization and Economic Innovation Development Conference. Chongqing, 2023.
- 8 Chen S., Li Y. Sanctions and Trade Reorientation: Evidence from Sino-Russian Agricultural Trade // China Economic Review. 2024. № 85. P. 102–119.
- 9 China National Petroleum Corporation (CNPC). China-Russia Oil and Gas Cooperation Annual Report 2023. Beijing : CNPC Economic and Technological Research Institute, 2024.
- 10 Chinese Academy of International Trade and Economic Cooperation, Ministry of Commerce. China Foreign Trade Situation Report. Beijing : CAITEC, 2024.
- 11 Chinese General Administration of Customs. China-Russia Bilateral Trade Data. URL: <http://www.customs.gov.cn>. (access date: 12.03.2026).
- 12 Chu T. Research on China-Russia Industrial Cooperation from the Perspective

of Global Value Chain // Journal of Harbin University of Commerce (Social Science Edition). 2023. № 3. P. 47–55.

13 Constantinescu C., Mattoo A., Ruta M. Trade Developments in 2022: The Impact of Geopolitical Shocks. Washington, DC : World Bank Policy Research Working Paper No. 10624, 2023.

14 De Benedictis L., Taglioni D. The Gravity Model in International Trade. Preferential Policies. Berlin : Springer, 2011.

15 Ding C. Current Situation, Problems and Prospects of Sino-Russian Automotive Industry Cooperation // Russian Studies. 2024. № 1. P. 89–108.

16 Evenett S., Pisani F. The Global Trade Alert Database: Methodology and Applications // World Trade Review. 2023. № 22(3). P. 389–406.

17 Fontagné L., Freudenberg M. Sectoral Trade Flows and the Measurement of Trade Complementarity Paris : CEPII Working Paper No, 2017.

18 Frank A. G. Capitalism and Underdevelopment in Latin America. New York : Monthly Review Press, 1967.

19 Gabuev A. Russia's Pivot to Asia: Myth or Reality? // Carnegie Endowment for International Peace, 2023.

20 General Administration of Customs of the People's Republic of China. China Customs Statistical Yearbook (2013–2025). Beijing : China Customs Press, 2025.

21 General Administration of Customs of the People's Republic of China. 2023 Sino-Russian Agricultural Trade Statistical Report. Beijing : China Customs Press, 2024.

22 Guo L. C., Wang X. An Empirical Analysis of Sino-Russian Trade Intensity Index and Trade Potential // Research on Financial and Economic Issues. 2021. № 8. P. 112–120.

23 Hausmann R., Hidalgo C. A. The Network Structure of Economic Output // Journal of Economic Growth. 2011. № 16(4). P. 309–342.

24 Hedlund S. Russian Energy Diplomacy in the Age of Sanctions // Post-Soviet Affairs. 2023. № 39(4). P. 289–306.

25 Helpman E., Krugman P. R. Market Structure and Foreign Trade: Increasing Returns, Imperfect Competition, and the International Economy. Cambridge, MA : MIT

Press, 1985.

26 International Energy Agency (IEA). Russia's Oil and Gas Exports to China: Impact of Sanctions and Infrastructure Constraints. Paris : IEA Publications, 2024.

27 International Monetary Fund (IMF). Direction of Trade Statistics. URL: <https://data.imf.org/dots>. (access date: 12.03.2026).

28 Kaczmarek M. Russia-China Relations in the Post-Western Era // International Affairs. 2022. № 98(5). P. 1687–1705.

29 Kotov A. V. Russian-Chinese Foreign Economic Relations: An Intersectoral Analysis // Economy of Regions, 2025, № 21(3). P. 643–654.

30 Krugman P. Increasing Returns, Monopolistic Competition, and International Trade // Journal of International Economics. 1979. № 9(4). P. 469–479.

31 Kruni P. R. China foreign trade flows: current state and development // Journal of International Economics. 2023. № 9(4). P. 69–83.

32 Lall S. The Technological Structure and Performance of Developing Country Manufactured Exports, 1985–1998 // Oxford Development Studies. 2000. № 28(3). P. 337–369.

33 Li N. Russian-Chinese Trade in the Context of Global Challenges: Dynamics, Issues, and Prospects // Herald of the Russian Academy of Sciences. 2025. № 3. P. 233–247.

34 Li Y. Q. 70 Years of Sino-Russian Relations: Retrospect and Prospect. Beijing : China Social Sciences Press, 2019.

35 Lin S. F., Davidson N. B. The impact of EU-US sanctions on China-Russia energy trade in the post-2014 geopolitical context: a gravity model perspective // R-Economy. 2026. № 1.

36 Lin Y. Q. Sino-Russian Economic and Trade Cooperation under the Belt and Road Initiative: Current Situation, Problems and Prospects // International Economic Cooperation. 2021. № 3. P. 34–48.

37 Liu H. Q., Zhang Y. Y. Sino-Russian Economic and Trade Cooperation: New Situation, New Opportunities and New Pathways. Beijing : Social Sciences Academic Press, 2023.

38 Liu Q. C., Zhang X. Structural Characteristics and Development Trends of Sino-Russian Economic and Trade Cooperation // *Modern International Relations*. 2023. № 2. P. 45–53.

39 Lukin A. The Russia-China Relationship: From Asymmetry to Parity? // *Asian Survey*. 2023. № 63(3). P. 456–482.

40 Michaely M. Trade Preferential Agreements in Latin America: An Ex-Ante Assessment. Washington, DC : World Bank Policy Research Working Paper No. 1583, 1996.

41 Michaely M. Trade Preferential Agreements in Latin America: An Ex-Ante Assessment. Washington, DC : World Bank Policy Research Working Paper No. 1583, 1996.

42 Ministry of Commerce of China. Russia Gradually Abolishes Liberalized Automobile Certification Policy. Economic and Commercial Office of the Chinese Embassy in the Russian Federation, 2023.

43 Movchan A., Giucci R. Import Substitution in Russia: Achievements and Failures. Institute for Economic Research and Policy Consulting, 2023.

44 Ouyang X. Y. A Study on the Profit Distribution and Risk Sharing Mechanisms of Sino-Russian Energy Cooperation // *Eurasian Economy*. 2024. № 2. P. 34–51.

45 Overland I., Braut-Hegghammer M. Russian Energy Strategy in the Asia-Pacific: Implications for Australia. Canberra: Australian Strategic Policy Institute, 2022.

46 Overland I., Kubayeva G. The Power of Siberia-2 Pipeline: Geopolitics, Economics, and Climate Implications // *Energy Research & Social Science*. 2024. № 112. P. 103–118.

47 Prebisch R. The Economic Development of Latin America and Its Principal Problems // *Economic Bulletin for Latin America*. 1950. № 7(1). P. 1–22.

48 Ricardo D. On the Principles of Political Economy and Taxation. London : John Murray, 1954.

49 Rosstat (Russian Federal State Statistics Service). URL: (access date: 15.03.2026).

50 Russian Federal Customs Service. Russian Foreign Trade Statistics. Moscow:

Russian Federal Customs Service Publishing, 2024.

51 Russian Federal Service for Veterinary and Phytosanitary Surveillance (Rosselkhoz nadzor). Compendium of Sino-Russian Agricultural Market Access Protocols, 2024.

52 Singer H. W. The Distribution of Gains between Investing and Borrowing Countries // American Economic Review. 1950. № 40(2). P. 473–485.

53 Sputnik. Director of Russian Academy of Sciences Institute: Priority Is Not to Increase Russia-China Trade Volume, but Industrial Cooperation. URL: <https://big5.sputniknews.cn/20250905/1067329742.html>. (access date: 14.02.2026).

54 UN Comtrade Database. URL: <https://comtradeplus.un.org/> (access date: 12.02.2026).

55 UN Comtrade Database. Commodity Trade Statistics Database. URL: <https://unstats.un.org/unsd/trade/default.asp> (access date: 12.02.2026).

56 Vollrath T. L. A Theoretical Evaluation of Alternative Trade Intensity Measures of Revealed Comparative Advantage // Review of World Economics. 1991. № 127(2). P. 265–280.

57 Wallerstein I. The Modern World-System: Capitalist Agriculture and the Origins of the European World-Economy in the Sixteenth Century. New York : Academic Press, 1974.

58 Wang J. A Study on the Complementarity and Competitiveness of Agricultural Trade between China and Russia // Issues in Agricultural Economy. 2022. № 5. P. 98–107.

59 Wang X. J. Sino-Russian Agricultural Cooperation: Transformation and Upgrading from Trade to Investment // Northeast Asia Forum. 2023. № 32(4). P. 56–72.

60 Website of Xi Jinping Thought on Diplomacy and China's Diplomacy in the New Era. Chinese and Russian Scholars Discuss New Opportunities for Bilateral Cooperation. URL: https://cn.chinadiplomacy.org.cn/2025-06/09/content_117917-718.shtml. (access date: 15.04.2026).

61 Wei M. A Study on China-Russia Goods Trade and Its Border Effect. Jinan : Shandong University of Finance and Economics, 2024.

62 World Bank. World Development Indicators: Trade Statistics. URL: <https://data.worldbank.org/>. (access date: 15.02.2026).

63 World Trade Organization (WTO). Trade Profiles: China and Russian Federation. Geneva : WTO Publications, 2023.

64 Xing G. C. Sino-Russian Regional Cooperation in the Context of the Belt and Road and Eurasian Economic Union Alignment // International Economic Review. 2024. № 6. P. 43–62.

65 Xu P. L. Potential, Obstacles and Countermeasures of Sino-Russian Economic and Trade Cooperation under Sanctions // Russian, East European and Central Asian Studies. 2023. № 5. P. 12–22.

66 Yang X. Y. An Analysis of Sino-Russian Trade Complementarity and Competitiveness: An Empirical Study Based on RCA and GL Indices // World Economy Studies. 2023. № 6. P. 78–89.

67 Yu M., Xu R. A Study on China-Russia Economic and Trade Cooperation from the Perspective of China-Mongolia-Russia Economic Corridor // Studies on Financial and Economic Theory. 2025. № 4.

68 Zhang H. X., Wang H. J. A Study on the Evolution and Optimization Path of Sino-Russian Trade Structure // Russian, East European and Central Asian Studies. 2022. № 4. P. 56–74.

69 Zhao J. The Evolution and Prospects of Sino-Russian Energy Trade under Sanctions // Eurasian Economy. 2023. № 4. P. 43–59.