



DISTINGUISHING GAINS FROM SPECIALIZATION AND GAINS FROM EXCHANGE: AN ANALYSIS OF THE DIFFERENCES IN WTO ACCESSION BENEFITS BETWEEN CHINA AND THE UNITED STATES AND AN EXPLANATION OF CHINA'S INTERNATIONAL SUCCESS

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Abstract

This paper takes the classical theoretical distinction between Gains from Specialization and Gains from (Exchange) Trade as its core analytical framework. Against the backdrop of global value chain (GVC) division of labor, it redefines the sources, structure, transmission mechanisms, and measurement methods of international trade gains. It systematically compares the differences in trade gain models, distribution structures, realization paths, and policy effects between China and the United States under the WTO framework. The study finds that China's international success since its WTO accession is essentially a dual gain superposition and dynamic upgrading dominated by gains from specialization and supported by gains from exchange. Relying on a complete industrial system, large - scale factor allocation efficiency, continuous institutional opening - up, and technology absorption and innovation, China has achieved export scale expansion, industrial structure upgrading, GVC climbing, and sustained improvement of total factor productivity. The United States has formed a gain structure with division gains from high - end service industry + exchange gains from the US dollar system as its core. The traditional merchandise trade deficit indicator seriously underestimates its real trade gains, while recent unilateral tariffs and protectionist policies have significantly eroded its long - term accumulated division gains and exchange dividends.

This paper further constructs a three - dimensional measurement framework of cost - productivity - quality, using authoritative data from WTO - TiVA, China Customs, the National Bureau of Statistics, and UNCTAD to systematically measure the unit output cost, labor productivity, total factor productivity, export domestic value - added rate, product technical complexity, and quality index in China's industrial structure adjustment from 2001 to 2025. The results show that since its WTO accession, China's manufacturing unit cost has continued to decline, labor productivity has grown at an average annual rate of over 8%, and export product quality and technical complexity have increased by more than 120%, forming a virtuous cycle of "low - cost advantage - high - efficiency production - high - quality supply." This is the micro - foundation for China to continuously expand division gains, optimize exchange gains, and achieve sustainable international success.

The research shows that China's international success is not a simple expansion based on low factor costs, but the result of the dynamic release of comparative advantages, continuous deepening of institutional reform, technology spillover from foreign investment, improvement of the multilateral trading environment, and proactive adjustment of national development strategies. The conclusions clarify the real sources of international trade gains, refute the one - sided view of judging trade gains or losses by trade balance, and provide theoretical support and empirical evidence for understanding China's development path after WTO accession, promoting high - quality development of foreign trade in the new era, and coping with changes in the global economic and trade pattern.

Keywords: Gains from Specialization; Gains from Exchange; Global Value Chain; Sino - US Trade Gains; Industrial Structure Adjustment; Productivity Improvement; Product Quality; WTO

Section1 Introduction

1.1 Research Background

On December 11, 2001, China officially joined the World Trade Organization (WTO), a landmark event in China's reform and opening - up process. It marked

China's transition from limited - scope, partial opening to comprehensive, multi - dimensional, and wide - ranging full opening, and from passively adapting to international rules to actively integrating into and gradually participating in global economic governance. Over the more

than twenty years since its accession, China has deeply embedded itself into global value chains, fully participated in international division of labor and exchange, achieved leapfrog development in foreign trade, and attained remarkable accomplishments in economic and social development.

In terms of trade scale, China's total goods imports and exports grew from US\$509.65 billion in 2001 to RMB 45.47 trillion in 2025, an increase of nearly 10 times at constant prices, making it the world's largest goods trading nation for nine consecutive years; its share of global exports rose from 4.3% to over 14%, becoming the largest trading partner for more than 120 countries and regions. In terms of trade structure, China achieved a historic transformation from being dominated by labor - intensive products to being led by capital - and technology - intensive products. Mechanical and electrical products became the largest export category, and the "new trio" of electric vehicles, photovoltaic products, and lithium batteries became new growth poles for exports, reaching nearly RMB 1.3 trillion in 2025, an increase of 3.5 times from 2020. The international competitiveness of high - tech products such as industrial robots, high - end equipment, and communication equipment has significantly strengthened.

In terms of economic and social development, WTO accession drove China's total GDP to increase by about 14 times, with per capita GDP jumping from around US\$1,000 to US\$14,000, successfully entering the ranks of upper - middle - income countries; foreign trade - related employment remained above 180 million people, promoting the continuous transfer of rural labor to industry and cities, and the urbanization rate rose from 39.1% to 66.2%; China's contribution to global economic growth has remained around 30% for many years, making it a core stabilizer and engine of world economic growth. In terms of institutional construction, China fully fulfilled its accession commitments, reducing the arithmetic average tariff from 15.3% to below 7.5%, and reviewed and revised over 192,000 laws, regulations, and policy documents at the central and local levels, establishing a market economy system compatible with multilateral trade rules, and forging a unique path of "promoting reform through opening - up, promoting development through reform, and promoting transformation through development."

In stark contrast to China, the United States, as a core founding member of the WTO and the world's largest economy, has in recent years undergone a fundamental shift in its attitude toward the multilateral trading system, transforming

from an active advocate and rule - maker to a doubter and disruptor. Since 2018, the US has continuously imposed high tariffs on China, pushed for industrial and supply chain "decoupling and breaking links," obstructed the normal operation of the WTO dispute settlement mechanism, and used the "long - term US trade deficit with China" as a pretext to accuse the multilateral trading system of "harming US interests." However, objective data show that the US has long maintained its position as the world's largest surplus country in services trade, with a surplus of nearly US\$300 billion in 2024. The overseas profits of multinational corporations, seigniorage gains from dollar hegemony, and low - price consumer welfare from global goods constitute huge implicit trade gains. The traditional customs statistics on the goods trade deficit seriously distort or even underestimate the US's real trade gains.

In the new era where global value chains are deeply segmented, intermediate goods cross borders multiple times, and international division of labor has deepened from the product level to the task level, the traditional criterion of judging trade gains based on "trade surplus or deficit" has become invalid and cannot reflect the real gains a country obtains from participating in international division of labor and exchange. Against this

practical background, this paper takes the most classical and fundamental distinction in international trade theory—Gains from Specialization and Gains from Exchange—as its analytical framework to redefine, measure, and compare the sources, structure, distribution, and effects of trade gains between China and the US under the WTO framework, focusing on answering the following core questions:

First, under conditions of global value chain division of labor, how can we scientifically define, distinguish, and measure gains from specialization and gains from exchange? What revisions and adaptations are needed for traditional trade gain theory?

Second, under the same WTO multilateral framework, what fundamental differences exist between China and the US in the source structure, distribution mechanism, and realization path of trade gains? Why has China been able to achieve sustained, stable, large - scale, and systematic international success?

Third, during the process of rapid industrial structure adjustment and continuous export scale expansion in China, what synergistic evolution pattern do cost control, labor productivity improvement, and product quality upgrading exhibit? How can systematic and quantifiable measurement prove that China's international

success is based on efficiency improvement and quality upgrading rather than simple low - cost expansion?

Fourth, is China's international success after WTO accession the result of factor endowment dividends, external environment opportunities, or multiple endogenous drivers such as institutional change, technology absorption, and strategic adjustment? What implications does its deep mechanism have for China's promotion of high - level opening - up in the new era?

Systematically answering the above questions is not only of great theoretical value—promoting the innovation and improvement of international trade theory in the era of global value chains — but also has strong practical significance, as it can scientifically explain China's development achievements since WTO accession, clarify the truth about Sino - US trade gains, and provide theoretical support and policy reference for China's transition from a "big trading nation" to a "strong trading nation" in the new era.

1.2 Research Significance

1.2.1 Theoretical Significance

First, it clarifies and deepens the conceptual boundaries, theoretical connotations, and modern forms of gains from specialization and gains from exchange, incorporating classical trade theory,

neoclassical factor endowment theory, and new classical division of labor theory into a unified analytical framework. It corrects the limitations of traditional trade gain theory under global value chain division, promoting the contemporary and localized innovation of basic international trade theory. Traditional trade theory takes final product trade as its analytical object, while modern trade is characterized by intermediate goods trade and task - based division. Through theoretical reconstruction, this paper restores the ability of classical division and exchange theories to explain contemporary trade gains.

Second, it breaks through the traditional thinking trap of "judging gains and losses by trade balance" and constructs a three - dimensional comprehensive gain measurement system based on trade value - added + productivity + product quality, replacing traditional customs statistics of export value and trade balance. It provides new theoretical tools, methodological support, and evaluation standards for scientifically measuring the real gains a country obtains from participating in international division of labor and exchange, enriching the research connotations of GVC income distribution theory, open macroeconomics, and development economics.

Third, it establishes a complete logical chain of industrial structure adjustment → cost change → productivity improvement → quality upgrading → expansion of trade gains, linking macro - level trade gains with micro - level enterprise production efficiency, cost control, and product quality, and combining open development with industrial upgrading. This enhances the explanatory and guiding power of trade theory for the industrialization, modernization, and internationalization processes of developing countries, filling the gap in existing research that focuses heavily on macro statistics and lacks micro foundations.

Fourth, through a systematic comparison of the trade gain structures of China and the US, it reveals the differences in gains obtained by countries with different factor endowments, different institutional systems, and different stages of development within the same multilateral trading system. It improves the theoretical framework of "country heterogeneity → division status → trade gains," providing a unified theoretical basis for explaining contemporary global trade imbalances, interest distribution patterns, and international economic and trade frictions, and promoting the shift of international trade theory from "homogeneous country analysis" to "heterogeneous country analysis."

1.2.2 Practical Significance

First, it scientifically explains China's international success over more than twenty years since WTO accession, systematically demonstrating that China's development achievements are the inevitable result of fully leveraging comparative advantages, continuously deepening reform and opening - up, and actively integrating into the global division of labor system. It comprehensively dispels one - sided or even erroneous perceptions such as "China profits only from low factor costs" and "China harms the interests of its trading partners," providing solid factual, data, and theoretical support for China to cope with external economic and trade frictions, participate in global economic governance, and tell the story of China's opening - up.

Second, it clarifies the real structure and distribution pattern of Sino - US trade gains, fully proving that the US has long obtained huge implicit gains from the global division of labor system and the dollar hegemony system. The so - called "trade deficit as a loss" argument is neither theoretically logical nor empirically valid. This provides a scientific basis for China to take the initiative and occupy the moral high ground in Sino - US trade negotiations, multilateral trading system reform, and global economic and trade

rule - making.

Third, through systematic and panoramic measurement of cost, productivity, and quality in China's industrial structure adjustment process, it accurately identifies the sources, composition, and dynamic trends of China's foreign trade competitive advantages. It provides quantitative references, directional guidance, and policy levers for promoting the high - end, intelligent, and green transformation of China's manufacturing industry, enhancing its position in global value chains, and expanding high - value - added, high - efficiency, and high - quality trade gains.

Fourth, it systematically summarizes the successful model, internal logic, and realization path of China's international success under the WTO framework, providing a reference, replicable, and operable Chinese solution for developing countries to integrate into economic globalization, advance industrialization, enhance trade gains, and achieve economic catch - up and modernization. It contributes to building a more open, inclusive, balanced, and win - win economic globalization.

Fifth, it provides policy implications for China to promote high - level opening - up, achieve high - quality development of foreign trade, and build a new development pattern in the new era. The

conclusions of this paper indicate that China's future open development must shift from scale expansion to quality and efficiency improvement, from factor - driven to innovation - driven, and from opening up based on the flow of goods and factors to institutional opening - up based on rules, regulations, management, and standards, providing theoretical support for major national strategic deployments.

1.3 Research Content, Framework and Methods

1.3.1 Research Content

This paper is divided into seven sections, with the core research content as follows:

Section 1 is the introduction. It elaborates the research background and problem statement, clarifies the theoretical and practical significance, defines the core research content, builds the research framework, and explains the research methods, data sources, innovations, and limitations.

Section 2 presents the theoretical foundations and literature review. It defines core concepts such as gains from specialization, gains from exchange, and total trade gains; reviews the theoretical origins of classical trade theory, neoclassical trade theory, and new classical division of labor theory, making theoretical adaptations and corrections in light of GVC

division characteristics; and systematically reviews relevant literature on trade gain measurement, China's WTO accession gains, and Sino - US trade gain differences, providing a literature assessment.

Section 3 analyzes China's gains from specialization and exchange after WTO accession. From the production side, it describes China's division gains: export scale expansion, GVC embedding, and industrial structure upgrading. From the consumption and circulation side, it describes China's exchange gains: market diversification, tariff concessions, and institutional opening - up. Finally, it presents the comprehensive gains in economic growth, job creation, and global status enhancement.

Section 4 analyzes the structure of US trade gains and the erosion effects of policies. It reveals US division gains: service trade advantages and global profits of multinational corporations; US exchange gains: low - price consumer welfare and dollar hegemony seigniorage; and analyzes the erosion effects of tariff policies since 2018 on the US's own trade gains: cost pass - through, trade diversion, and efficiency losses.

Section 5 provides a structural comparison of Sino - US trade gains. It systematically compares the two countries' gain

models from five dimensions: sources of gains, distribution mechanisms, value chain positioning, policy orientation, and sustainability.

Section 6 constructs a three - dimensional measurement framework of cost - productivity - quality to empirically test China's international success. It systematically measures the dynamic processes of declining unit output cost, leaps in labor productivity and total factor productivity, and upgrading of export product quality and technical complexity in China since WTO accession. It then extracts the five core drivers of China's international success: release of comparative advantages, institutional change, foreign capital technology spillovers, improvement of the multilateral environment, and strategic adjustments.

Section 7 presents conclusions, implications, and prospects. It summarizes the core conclusions of the paper, proposes policy implications for China to expand high - quality trade gains, enhance its GVC position, and promote high - level opening - up in the new era, and points out directions for further research.

1.3.2 Research Framework

This paper follows the logical thread of "theoretical construction, realistic depiction, difference comparison, empirical measurement, mechanism explanation,

policy implications": based on the distinction between gains from specialization and gains from exchange - depicting the trade gain structures of China and the US - comparing the differences in gains between the two countries - three - dimension measuring China's industrial upgrading and gain realization - explaining the mechanism of China's international success - proposing policy implications.

1.3.3 Research Methods

(1) Theoretical Analysis

Based on Adam Smith's theory of absolute advantage, David Ricardo's theory of comparative advantage, the Heckscher - Ohlin factor endowment theory, and Yang Xiaokai's new classical division of labor theory, this paper defines gains from specialization and gains from exchange, constructs a modern analytical framework of "production - side division gains - circulation - side exchange gains - GVC value - added," and completes theoretical reconstruction and adaptation.

(2) Comparative Method

Horizontal comparison: sources, structure, distribution mechanisms, policy effects, and value chain positions of trade gains between China and the US.

Longitudinal comparison: dynamic changes in China's industrial structure, trade patterns, cost, productivity, and

product quality before and after WTO accession.

International comparison: comparison of cost, efficiency, and quality indicators between China and developed economies as well as developing economies.

(3) Empirical Data Analysis

Using authoritative public data from the WTO - TiVA database, UNCTAD product technical complexity database, China Customs import and export data, National Bureau of Statistics industrial statistics, World Bank WDI database, and Federal Reserve economic data, this paper quantitatively measures, trend - analyzes, and empirically tests core indicators such as trade scale, value - added, unit cost, labor productivity, total factor productivity, and product quality index, ensuring the objectivity, reliability, and scientific validity of the conclusions.

(4) Structural Analysis and Inductive - Deductive Method

This paper decomposes the formation mechanism of China's trade gains from multiple dimensions: production side, consumption side, institutional side, value chain side, and strategic side. It uses deduction to derive modern applicable conclusions from classical theories and induction to summarize the internal mechanism and general laws of China's international success from the practice of

its WTO accession.

1.4 Innovations and Limitations

1.4.1 Possible Innovations

First, theoretical perspective innovation. It takes the classical distinction between gains from specialization and gains from exchange as the core framework and systematically reconstructs and adapts it for the era of global value chains, breaking through the traditional trade balance mindset and constructing a new analytical system for trade gains, providing a new perspective for understanding contemporary international trade gains.

Second, analytical framework innovation. It constructs a three - dimensional measurement framework of cost - productivity - quality, closely linking macro - level trade gains with micro - level industrial upgrading, achieving an expansion from "scale gains" to "quality and efficiency gains," and comprehensively and scientifically quantifying the micro - foundations of China's international success.

Third, research content innovation. It systematically compares the trade gain differences between China and the US under the same WTO framework, clarifying the US's implicit gains and China's real gains, refuting the "deficit as loss" argument, while fully explaining the multiple drivers of China's international

success, combining theoretical depth with practical relevance.

1.4.2 Limitations

First, due to the limited availability of micro - level enterprise data, the decomposition of division gains and exchange gains at the enterprise level is not sufficiently detailed. Future research could use matching of industrial enterprise databases and customs data for micro - econometric testing.

Second, the dynamic impact analysis of external shocks such as geopolitics and global value chain restructuring is primarily qualitative. Future research could construct dynamic computable general equilibrium models for quantitative simulation.

Third, this paper focuses on the comparison between China and the US. Future research could expand to include more developing and developed countries for broader international comparative studies to enhance the generalizability of the conclusions.

Section2 Theoretical Foundations and Literature Review

2.1 Definition of Core Concepts

2.1.1 Gains from Specialization

Gains from Specialization refer to the benefits a country obtains by reallocating

its factors of production - land, labor, capital, technology, data, etc. - from low - efficiency, low - value - added, and un-competitive sectors and tasks to high - efficiency, high - value - added sectors and tasks where it has a comparative advantage. Through specialized, large - scale, intensive, and refined production, it improves labor productivity and total factor productivity, expands total output, reduces unit production costs, and enhances the quality and capacity of product supply, thereby raising the overall welfare level of society.

The core source of Gains from Specialization is improvement in production efficiency and optimization of resource allocation. These gains are realized before cross - border exchange occurs, through the optimization of the domestic production structure. Therefore, they are also called production - side gains, efficiency gains, or supply - side gains.

Under different theoretical paradigms, the sources of division gains differ:

In classical trade theory, division gains come from absolute or relative differences in labor productivity;

In neoclassical trade theory, division gains come from the matching of factor endowment structures with industrial factor intensities;

In new classical trade theory, division

gains come from increased specialization levels and improved transaction efficiency;

In the era of global value chains, division gains come from task specialization, scale effects, technology spillovers, industrial agglomeration, and import substitution of intermediate goods.

Gains from Specialization have three typical characteristics:

First, production orientation, directly reflected in increased output, lower costs, higher efficiency, and better quality;

Second, structural optimization, driving resources toward advantageous industries, enterprises, and tasks, promoting industrial structure transformation and upgrading;

Third, dynamic sustainability, relying on technological progress, human capital accumulation, scale effects, and industrial chain coordination to achieve continuous dynamic improvement.

In short, the core question answered by Gains from Specialization is: By focusing on producing the products or tasks in which it has the greatest advantage, how much more value can a country create, how much more efficiency can it achieve, and how much can it reduce costs?

2.1.2 Gains from Exchange

Gains from Exchange refer to the benefits a country obtains, without changing its

domestic production structure or increasing its total domestic output, by exporting its own products and services and importing foreign products and services through the international market at more favorable international prices. Through cross - border exchange, it optimizes the consumption structure, reduces consumption costs, expands product choices, and enhances consumer utility and social welfare.

The core sources of Gains from Exchange are differences between international and domestic prices, market opening, trade facilitation, and improvement of the institutional environment. They do not directly increase domestic production efficiency but achieve optimal allocation of use value through cross - border exchange of goods and services. Therefore, they are also called consumption - side gains, circulation - side gains, or demand - side gains.

Gains from Exchange mainly come from four aspects:

First, direct welfare improvement from price differences between international and domestic markets;

Second, increased consumer utility from greater diversity of imported products;

Third, reduced transaction costs from tariff reductions, removal of non - tariff barriers, and improved trade facilitation;

Fourth, stability and risk reduction from multilateral rules, market access, and intellectual property protection.

Gains from Exchange have three typical characteristics:

First, consumption and market orientation, directly reflected in improved consumer welfare, lower import costs, and expanded market scope;

Second, instantaneity, realized as soon as exchange is completed;

Third, dependence on institutions and environment, highly dependent on external conditions such as tariff policies, exchange rate stability, market access, and multilateral trade rules.

In short, the core question answered by Gains from Exchange is: Without increasing domestic production, only through cross - border exchange, how much more utility can a country obtain, how much more welfare can it improve, and how much can it reduce costs?

2.1.3 Total Trade Gains and Adaptation to Global Value Chains

The core formula of traditional trade theory:

Total Trade Gains = Gains from Specialization + Gains from Exchange

In the era of final product trade, a country produces and exports complete final products, and the boundaries between

division gains and exchange gains are clear and easy to calculate. However, today, where vertical specialization in global value chains has become the dominant model, production processes are fragmented across national borders into multiple tasks such as R&D, design, component production, assembly, marketing, and branding. Intermediate goods cross borders multiple times, and final exports contain a large amount of foreign value - added and double - counted components. Traditional customs statistics on export value and trade balance cannot truly reflect a country's actual trade gains. Therefore, modern trade gain analysis must make two key theoretical adaptations:

First, adaptation of accounting indicators: Use Trade in Value Added (TiVA) as the core accounting indicator to measure the domestic value added (DVA) truly created by a country in its exports, Excluding foreign intermediate goods value and double - counted parts, to truly reflect division gains.

Second, adaptation of division form: The division of labor has deepened from "inter - product division and intra - product division" to "inter - task division." A country no longer produces a complete product but only undertakes a certain production task. Division gains are reflected

in task value - added and task efficiency improvement; exchange gains include both final product exchange and intermediate goods exchange, and are highly dependent on institutional and rule - based dividends.

After theoretical adaptation, this paper establishes the core analytical framework applicable to the era of global value chains: The essence of a country's international success under the WTO framework = coordinated expansion and dynamic upgrading of Gains from Specialization and Gains from Exchange. China's international success is a typical example of division gains dominating, exchange gains supporting, and dual gains continuously growing.

2.2 Theoretical Origins

2.2.1 Classical Trade Theory

Adam Smith (1776) proposed the theory of absolute advantage in *The Wealth of Nations*, systematically discussing the sources of gains from division of labor and exchange for the first time. Smith argued that division of labor is the fundamental reason for increasing labor productivity. International division of labor enables countries to specialize in producing goods in which they have an absolute advantage, achieving output expansion and cost reduction, thus forming Gains from Specialization. On this basis,

surplus products are exchanged across borders to achieve mutual benefits, forming Gains from Exchange. The core logic is: division creates gains, exchange realizes gains; division is the foundation, exchange is the extension.

David Ricardo (1817) proposed the theory of comparative advantage in *On the Principles of Political Economy and Taxation*, generalizing the logic of division: even if a country has no absolute advantage in producing any good, as long as there are relative efficiency differences between different goods, it can obtain division gains by specializing in producing the good with a smaller comparative disadvantage. Through exchange, both countries can achieve higher consumption and welfare levels than under Autarky. The theory of comparative advantage proves that: Gains from Specialization are universal, and Gains from Exchange are mutually beneficial, laying the most solid theoretical foundation for countries to participate in free trade.

Classical trade theory established the gain structure of division first, exchange in coordination, pointing out that the fundamental source of trade gains is improvement in production efficiency, not simple commodity circulation. This directly serves as the theoretical source for this paper's analysis of China's

manufacturing division gains after WTO accession.

2.2.2 Neoclassical Trade Theory

The Heckscher - Ohlin model (H - O model, 1933) proposed the factor endowment theory, explaining international division of labor and trade gains from the perspective of relative scarcity of factors of production. The theory holds that differences in relative endowments of factors such as labor, capital, land, and technology among countries determine differences in relative product costs and prices. Countries should specialize in producing and exporting goods that intensively use their abundant factors and import goods that intensively use their scarce factors.

Within this framework:

Gains from Specialization come from optimal allocation of factors, with prices and returns of abundant factors increasing;

Gains from Exchange come from the tendency toward equalization of commodity prices internationally, with expanded consumption choices and improved welfare levels.

Factor endowment theory highly fits the reality of China in the early stage of its WTO accession: China had abundant labor and scarce capital and technology, so it specialized in producing labor -

intensive products, obtaining significant division gains; by importing capital goods, technology equipment, and resources and energy, it obtained exchange gains, achieving dual improvement in factor returns and consumption welfare.

2.2.3 New Classical Division of Labor Theory

Represented by Yang Xiaokai and Huang Youguang (1990), new classical economics takes specialization and division of labor as the core analytical tool, endogenizes transaction efficiency, and establishes a unified analytical logic for domestic and international trade. Its core ideas include:

First, increased division of labor directly raises labor productivity, generating division gains;

Second, transaction efficiency (institutions, transportation, communication, tariffs, rules) determines whether division of labor can expand to the international scope;

Third, trade gains are the joint result of deepening division of labor and improved cross - border exchange efficiency;

Fourth, institutional reform and improvements in transaction efficiency are key to unlocking the potential of division of labor.

The new classical theory provides key

insights for this paper: China's international success after WTO accession came not only from its labor factor advantage but also from the fact that WTO accession greatly reduced cross - border institutional transaction costs, improved transaction efficiency, and transformed China's huge domestic division potential into real international division gains. This directly supports the core role of China's institutional opening - up.

2.3 Literature Review

2.3.1 Studies on Measurement of Trade Gains

Traditional measurement of trade gains centered on trade balance and terms of trade. Feenstra (2015), Krugman et al. (2018) pointed out that under GVC division, traditional measurement methods suffer from serious double - counting problems and cannot reflect real gains.

Hummels et al. (2001) proposed a measurement framework for vertical specialization, laying the foundation for trade in value - added accounting. The WTO - OECD released the TiVA database, making the measurement of domestic value - added in exports mainstream. Fan Maoqing and Huang Wei (2014), Duan Yuwan et al. (2021) measured China's export domestic value - added rate based on the TiVA database, finding that China's value - added rate has been continuously

increasing and its GVC position steadily climbing.

Li Feng (2016) proposed a theory of factor return differences and trade division, pointing out that different countries obtain different trade gains due to differences in factor endowments, with developing countries obtaining more labor returns and developed countries obtaining more capital and technology returns.

Existing research generally agrees that trade value - added is the core indicator for measuring division gains, while terms of trade and consumer welfare are important indicators for measuring exchange gains. However, research that incorporates both into a unified framework and systematically compares China and the US is still relatively scarce.

2.3.2 Studies on China's WTO Accession Gains

Sheng Bin (2021), Yu Miaojie (2020) systematically studied the economic effects of China's WTO accession, arguing that accession promoted trade liberalization, intensified market competition, optimized resource allocation, and boosted economic growth and industrial upgrading.

2.3.2 Studies on China's WTO Accession Gains

Sheng Bin (2021), Yu Miaojie (2020)

systematically studied the economic effects of China's WTO accession, arguing that accession promoted trade liberalization, intensified market competition, optimized resource allocation, and boosted economic growth and industrial upgrading. The First Financial Research Institute (2023) released a report pointing out that China's two decades of WTO accession achieved a transformation from "world factory" to "big trading nation," with significant trade growth and welfare improvement.

Zhang Erzhen and Dai Xiang (2018), Jiang Xiaoqian (2022) emphasized that the core gains of China's WTO accession were not only trade scale expansion but also comprehensive gains from institutional reform, technological progress, and governance capacity improvement, forging a unique path of promoting reform and development through opening - up.

Existing research fully affirms the great achievements of China's WTO accession, but most of it is from the perspectives of macro growth, trade scale, and industrial structure. Systematic explanations based on the distinction between division gains and exchange gains, combined with three - dimensional measurement of cost - productivity - quality, are relatively lacking.

2.3.3 Studies on Sino - US Trade Gain Differences

Liu Shiguo and Wu Haiying (2018), the Institute of World Economics and Politics of the Chinese Academy of Social Sciences (2025) studied and pointed out that the US goods trade deficit is misleading. The US obtains huge implicit gains through services trade, multinational corporation profits, and dollar hegemony, and traditional statistics seriously underestimate the US's real trade gains.

The academic community generally believes that the Sino - US trade imbalance is the result of the joint action of global division of labor, industrial transfer, and differences in consumption and savings structures, and that US consumers and multinational corporations are the biggest beneficiaries of Sino - US trade. However, existing research rarely conducts systematic, framework - based, quantitative comparisons of Sino - US gain structures from the classical theoretical perspective of gains from specialization and gains from exchange.

2.3.4 Literature Assessment

In summary, existing literature has achieved rich results in areas such as trade value - added measurement, China's WTO accession gains, and Sino - US trade imbalances, but there are still three

obvious shortcomings:

First, the theoretical framework is not unified enough, mostly studying division or exchange separately, rarely incorporating both into a unified analytical framework under global value chains;

Second, the micro - foundation is not solid enough, focusing heavily on macro trade scale and structure analysis, lacking systematic three - dimensional measurement of cost, productivity, and quality;

Third, the Sino - US comparison is not systematic enough, mostly focusing on trade imbalance and deficit issues, rarely conducting comprehensive comparisons from the perspectives of gain sources, distribution, value chains, policies, and sustainability.

This paper precisely addresses the above shortcomings by taking the distinction between gains from specialization and gains from exchange as a unified framework, combined with three - dimensional measurement and Sino - US comparison, to systematically explain China's international success under the WTO framework.

Section 3 China's Gains from Specialization and Exchange after WTO Accession

After joining the WTO in 2001, China fully fulfilled its commitments, significantly reduced tariffs, opened market

access, improved the legal environment, strengthened intellectual property protection, and rapidly and deeply integrated into the global production network and multilateral trading system. It formed a trade gain structure dominated by gains from specialization, supported by gains from exchange, with dual gains growing synergistically, achieving a comprehensive leap in production scale, industrial structure, trade patterns, and economic and social development.

3.1 China's Gains from Specialization: Scale Expansion and Value Chain Climbing

China's gains from specialization come primarily from the full - chain, large - scale, specialized, and intensive production of its manufacturing sector. Relying on factor endowment advantages such as labor, land, and industrial supporting capacity, as well as the world's unique complete industrial system, China has achieved efficient resource allocation, continuously rising labor productivity, continuous upgrading of industrial structure, and steady climbing of its position in global value chains.

3.1.1 Explosive Growth of Export Scale

WTO accession opened the door to a stable, transparent, and predictable global market for China. The most - favored -

nation treatment, fair competition environment, and dispute settlement mechanism provided by the multilateral trading system completely eliminated the uncertainty risks that had long constrained China's exports. China fully leveraged its comparative advantages and achieved sustained rapid growth in export scale.

Key data show:

- China's goods exports in 2001 were US\$266.098 billion, rising to RMB 25.46 trillion in 2024;
- China's total goods imports and exports in 2025 reached RMB 45.47 trillion, achieving growth for nine consecutive years;
- China's share of global exports rose from 4.3% in 2001 to over 14% in 2024;
- The number of countries and regions with which China had trade relations expanded from over 200 to 249 in 2025, achieving global coverage.

This scale expansion is not simple quantitative growth but a direct manifestation of the continuous deepening of specialized division of labor: production factors continuously concentrate in the manufacturing sector, advantageous industries, and export sectors, generating significant increasing returns to scale. Production efficiency continuously improves with scale expansion, unit costs continuously

decline, further enhancing international competitiveness, forming a positive cycle of "deepening division → efficiency improvement → export expansion → further deepening division."

From the perspective of the evolution of division models, China has gone through three stages:

- 2001 - 2010: dominated by processing trade of "two ends outside, large imports and large exports," specializing in labor - intensive assembly tasks;
- 2011 - 2020: the share of ordinary trade increased, import substitution of intermediate goods accelerated, and domestic industrial chain supporting capacity greatly improved;
- 2021 to present: the share of independent R&D, independent brands, and independent channels significantly increased, upgrading from "world factory" to "core of global supply chains."

This evolutionary process fully proves that China's export expansion is the result of productivity improvement from deepening specialized division of labor, not simple low - price competition.

3.1.2 Deep Embedding in Global Value Chains

Before WTO accession, China was mainly in the low - end assembly segment of global value chains, with low

domestic value - added rate, low technological content, and limited division gains. WTO accession pushed China to fully integrate into the global production network, achieving steady climbing of its value chain position through continuous deepening of division of labor.

This is mainly reflected in three aspects:

First, the export domestic value - added rate has continuously increased.

China's manufacturing export domestic value - added rate rose from about 55% in 2005 to over 69% in 2023, meaning that for every US\$100 of exports, the domestic value created by China increased from US\$55 to US\$69, significantly raising the division gain per unit of export.

Second, industrial chain completeness and import substitution of intermediate goods.

China is the only country in the world that has all industrial categories in the UN classification. Industries such as steel, electronics, machinery, chemicals, textiles, and equipment manufacturing have formed complete supporting systems. A large number of components, raw materials, and intermediate goods that were previously imported have been localized, continuously reducing external dependence and significantly enhancing the stability and autonomy of division gains.

Third, climbing from low - value - added tasks to high - value - added tasks.

In the early stage of WTO accession, China's division gains mainly came from simple processing and assembly.

At the current stage, China has formed strong international competitiveness in core component manufacturing, high - end equipment manufacturing, new energy, rail transit, communication equipment, photovoltaics, and electric vehicles, gradually extending to high - value - added tasks such as R&D and design, brand marketing, and supply chain management.

Typical indicators include:

- The share of equipment manufacturing products in exports rose to 59.4%;
- The share of high - tech products in exports exceeded 30%;
- Industrial robots achieved net exports;
- The "new trio" of electric vehicles, photovoltaics, and lithium batteries became globally leading high - end export products.

The continuous improvement of global value chain position indicates that China's gains from specialization have dynamically upgraded from "low efficiency, low value - added, passive embedding" to "high efficiency, high value - added,

active leadership." This is the core and most essential manifestation of China's international success.

3.1.3 Continuous Upgrading of Industrial Structure

WTO accession has driven China's industrial structure to upgrade rapidly, continuously, and orderly along the path of comparative advantage, which is a concentrated manifestation of the improved quality of gains from specialization.

Phase 1 (2001 - 2010): Dominated by labor - intensive products.

Exports of textiles, clothing, furniture, footwear, luggage, etc., grew rapidly, relying on low - cost labor to obtain division gains, solving large - scale employment and completing the primitive accumulation of industrialization.

Phase 2 (2011 - 2020): Mechanical and electrical products became the largest export category.

The share of exports of household appliances, mobile phones, computers, ships, automobiles, equipment manufacturing, etc., increased significantly. The sources of division gains shifted from simple labor cost advantages to multiple drivers such as capital deepening, scale effects, technology absorption, and management improvement.

Phase 3 (2021 to present): Technology -

intensive and green low - carbon products lead exports.

Electric vehicles, photovoltaic products, lithium batteries, industrial robots, high - end equipment, communication equipment, etc., have become the main export forces. The sources of division gains have shifted to technological innovation, intelligent manufacturing, green manufacturing, brand value, and standard setting, achieving a leap to the middle and high end of global value chains.

The essence of industrial structure upgrading is the continuous shift of specialized division of labor from low - efficiency, low - value - added sectors to high - efficiency, high - value - added sectors, bringing about comprehensive improvement in social labor productivity, resource allocation efficiency, and value creation capacity, constituting the core source of China's continuously expanding gains from specialization.

3.2 China's Gains from Exchange: Market Opening and Welfare Improvement

China's gains from exchange come from multiple dividends such as tariff concessions, market opening, diversification of trading partners, trade facilitation, and institutional opening - up. Without changing the domestic production structure, through cross - border exchange, China

has optimized its consumption structure, reduced import costs, expanded market space, and stabilized trade expectations, achieving a significant improvement in social welfare.

3.2.1 Diversification of Trading Partners

Since WTO accession, China has vigorously promoted a market diversification strategy, completely changing the pattern of excessive dependence on a few developed markets that existed before accession. The stability, sustainability, and risk resistance of China's exchange gains have greatly improved.

Key data:

- Dependence on US exports fell from 20.91% in 2000 to 14.67% in 2024;
 - The share of imports and exports with countries along the "Belt and Road" reached 51.9% in 2025, making it the largest trading partner block;
 - Trading partners cover 249 countries and regions worldwide, achieving all - round, multi - level, and wide - ranging global market coverage.
- Market diversification brings triple exchange dividends:
- First, reducing exposure to policy changes, demand fluctuations, and geopolitical risks in a single market;
 - Second, enhancing China's

bargaining power and initiative in international exchange, continuously improving the terms of trade;

- Third, expanding product diversity, improving welfare for both producers and consumers.

3.2.2 Tariff Concessions and Trade Facilitation

China fully, strictly, and earnestly fulfilled its WTO tariff reduction commitments, reducing the arithmetic average tariff from 15.3% in 2001 to below 7.5%. Non - tariff barriers were largely eliminated, and the level of trade facilitation continuously improved.

The reduction in exchange costs brings dual significant benefits:

For enterprises: lower costs for importing raw materials, components, technology equipment, and key resources enhance production competitiveness and profitability, further expanding gains from specialization;

For consumers: lower prices for imported consumer goods, food, medicine, luxury goods, automobiles, etc., with richer choices, significantly improving real purchasing power and welfare.

At the same time, China's large - scale export of low - cost, high - quality industrial goods to global markets effectively curbs global inflation, stabilizes global supply,

and reduces global consumption costs, forming positive external exchange gains and significantly enhancing China's position and voice in the global exchange system.

3.2.3 Dividends from Institutional Opening - up

WTO accession promoted systematic, all - round, and deep - seated institutional reform in China:

- Over 192,000 laws, regulations, and policy documents were reviewed and revised at the central and local levels;

- A unified, fair, transparent, and non - discriminatory market access system was established;

- Intellectual property protection was strengthened, creating a legal, international, and convenient business environment;

- Trade remedy, dispute resolution, and regulatory governance systems were improved.

Institutional opening - up greatly reduced the institutional transaction costs of cross - border exchange, stabilized the long - term expectations of foreign enterprises, investors, and trading partners, attracted long - term capital, technology, and talent inflows, and promoted the continuous deepening of stable trade relationships, transforming China's exchange gains

from "short - term price dividends" to "long - term institutional dividends," with greatly enhanced sustainability.

3.3 Comprehensive Gains: Overall Economic and Social Leap

The coordinated expansion, mutual reinforcement, and dynamic upgrading of gains from specialization and gains from exchange ultimately translated into all - round, comprehensive, and historic achievements in China's economic and social development.

3.3.1 Economic Growth and Income Improvement

From 2001 to 2025, China's total GDP grew by about 14 times, and per capita GDP jumped from around US\$1,000 to US\$14,000, successfully entering the ranks of upper - middle - income countries. Economic strength, technological capability, and comprehensive national power reached new levels.

3.3.2 Job Creation and Urbanization

Foreign trade - related industries directly drove employment of over 180 million people, promoting the large - scale transfer of rural labor to industry, services, and cities. The urbanization rate rose from 39.1% to 66.2%, achieving historic changes in urban - rural structure, employment structure, and social structure.

3.3.3 Global Contribution and Status Enhancement

China's contribution to global trade growth and economic growth has remained around 30% for many years, making it a core stabilizer, engine, and ballast of world economic growth. Its position as the world's largest goods trading nation, largest manufacturing nation, and largest holder of foreign exchange reserves has been continuously consolidated, and its international influence, appeal, and shaping power have significantly increased.

In summary, China's international success after WTO accession is the inevitable result of the coordinated expansion, mutual support, and dynamic upgrading of gains from specialization and gains from exchange: division gains provide a solid material foundation and supply guarantee for exchange gains, and exchange gains provide a broad market space and demand pull for division gains. Together, they have driven China's historic leap from a closed and semi - closed system to all - round opening, from a small trading nation to a big trading nation, and from low - end embedding to value chain climbing.

Section 4 Structure of US Trade Gains and Erosion Effects of Policies

In stark contrast to China's trade gain

structure dominated by manufacturing gains from specialization, the United States has formed a unique, composite, and implicit trade gain model with gains from specialization in high - end services as the core and gains from exchange based on dollar hegemony as an important support. The traditional customs statistics on the goods trade deficit not only fail to reflect the US's real trade gains but also seriously underestimate or distort the huge gains the US obtains from global division of labor and exchange. The unilateral tariffs and protectionist policies implemented since 2018 have not only failed to improve US trade gains but have significantly eroded its long - accumulated division gains and exchange dividends.

4.1 US Gains from Specialization: High - end Services and Value Chain Control

The US's gains from specialization do not come from large - scale, standardized, labor - intensive manufacturing tasks, but from high - value - added, high - tech, high - profit - margin, low - resource - consumption tasks such as technology, patents, brands, finance, data, services, and standards. It firmly occupies the two ends of the global value chain "smile curve," controlling core tasks, core technologies, and core rules to distribute most of the global value chain profits.

4.1.1 Absolute Advantage in Service Trade

The US is the world's largest surplus country in services trade and the most competitive country in global services trade, with a services trade surplus of nearly US\$300 billion in 2024, which can offset about 25% of its goods trade deficit.

The US's advantage in services trade is highly concentrated in high - value - added, high - monopoly, high - tech fields:

- Intellectual property use fees (patents, trademarks, copyrights, trade secrets);
- Financial services, insurance services, asset management services;
- Software and IT services, cloud computing, big data services;
- Business consulting, management services, legal services, accounting services;
- Higher education, medical services, cultural and entertainment services.

The common characteristics of these fields are: knowledge - intensive, technology - intensive, capital - intensive, highly global monopolistic, extremely high value - added rate, and less constrained by geography. The US obtains excess division gains by virtue of technological leadership, standard dominance, network effects, and brand monopoly.

The value created per unit of service export is much higher than that of goods export.

In short, the US's gains from specialization do not come from "producing more products," but from controlling core technologies, rules, standards, channels, and brands, and distributing most of the profits of global value chains.

4.1.2 Global Earnings of Multinational Corporations

US multinational corporations dominate the layout of global value chains. Through foreign direct investment, they transfer low - value - added, high - energy - consumption, high - land - consumption, labor - intensive manufacturing and assembly tasks to developing countries, while retaining high - value - added tasks such as R&D and design, brand operations, marketing channels, supply chain management, financial management, and headquarters services at home.

This global layout results in two seemingly contradictory but actually unified outcomes:

First, at the customs statistics level, a goods trade deficit appears.

Products are produced, exported, and sold overseas, and customs records show them as exports of the producing country and imports of the US, resulting in a US

goods trade deficit.

Second, at the multinational corporation level, huge implicit division gains are obtained.

Profits, patent fees, royalty fees, management fees, brand use fees, supply chain service fees, etc., generated from overseas production flow back to the US in the form of investment income and service trade income, constituting a large scale of implicit division gains outside statistics.

Authoritative research and official data show:

After deducting related - party transactions, intra - firm trade, and profit repatriation of multinational corporations, the actual US trade deficit would fall by about two - thirds, and the trade deficit with China would fall by about 30%.

This fully proves that the so - called US "trade deficit" is a natural result of global division of labor layout and multinational corporation operations, and is by no means a manifestation of "losing out or being harmed." The US's real division gains far exceed what customs statistics can reflect.

4.2 US Gains from Exchange: Consumer Welfare and Dollar Hegemony

The US's gains from exchange are huge

in scale, hidden in form, and continuously stable. They mainly come from global low - price consumer welfare and seigniorage gains from dollar hegemony, and are the fundamental source of the high welfare, low cost, and strong credit long enjoyed by US residents, enterprises, and the government.

4.2.1 Low - price Benefits for Consumers

Through large - scale, continuous, and stable imports of low - priced industrial goods, consumer goods, daily necessities, household products, and electronic products from developing countries and regions such as China, ASEAN, and Mexico, the US enables its consumers to meet their daily needs at very low costs. More of their disposable income can be spent on higher - order expenditures such as services, savings, investment, education, and healthcare, forming huge consumer exchange gains that benefit the entire population.

From the perspective of welfare economics, the scale of this exchange gain far exceeds the goods trade deficit itself. The essence of the US's large - scale imports is: exchanging dollar credit for real goods and services from around the world. US consumers are among the biggest beneficiaries of the global division of labor system.

4.2.2 Seigniorage Gains from the Dollar

As the world's core reserve currency, settlement currency, pricing currency, and intervention currency, the US dollar grants the United States three unparalleled and non - replicable institutional exchange dividends:

First, huge seigniorage gains.

The US obtains real goods, resources, assets, and services from around the world by issuing dollars and dollar assets, with almost no substantive consideration. This is the largest, most enduring, and most stable implicit exchange gain in economic history.

Second, no hard constraint on the balance of payments.

The US can maintain a trade deficit and current account deficit on a large scale for a long time without bearing the risk of currency crisis, exchange rate collapse, or international payment crisis. This is an institutional advantage unimaginable for other countries.

Third, the lowest global financing cost.

The global financing cost of US government, enterprises, and residents has long been significantly lower than the global average, with less interest expenditure and higher asset returns, forming sustained wealth appreciation and welfare improvement.

In summary, the US's gains from exchange can be highly summarized as: exchanging dollar credit for global goods and using global division of labor to support domestic consumption. Its real exchange gains far exceed the scale that traditional statistics can reflect.

4.3 Erosion of Trade Gains by Tariff Policies

Since 2018, the US has continuously pursued unilateral tariffs, trade protection, and industrial chain decoupling policies, attempting to reduce the trade deficit, promote manufacturing reshoring, and "protect US interests" by imposing additional tariffs. However, theoretical logic and empirical data consistently show that these policies have not only failed to achieve their intended goals but have seriously, continuously, and comprehensively eroded the US's long - accumulated gains from specialization and gains from exchange.

4.3.1 Tariff Cost Pass - through and Welfare Loss

Mainstream economic research and a large number of empirical results from the Federal Reserve, US Customs, and academia consistently show that more than 90% of the cost of US tariffs is borne by US importers, wholesalers, retailers, consumers, and downstream enterprises,

not by the exporting countries.

Key data and facts:

- The US average effective tariff rate rose sharply from 2.6% to 13.7%;
- Research estimates show that reciprocal tariff policies could lead to an average annual direct loss of US\$3,800 for ordinary US families;
- Low - income groups and low - income families, because of the high proportion of necessities in their consumption expenditure, are hit hardest by tariff - driven price increases, suffering the most severe welfare losses.

Tariffs are essentially "punitive taxes imposed on domestic consumers and enterprises," directly reducing consumer exchange gains, raising domestic inflation levels, weakening household welfare and enterprise competitiveness, and seriously eroding US exchange gains.

4.3.2 Trade Diversion and Deficit Illusion

US tariff policies have not achieved the goals of manufacturing reshoring or deficit reduction; they have only achieved geographical trade diversion:

- Imports from China decreased by about 28%;
- Imports from Vietnam, Thailand, India, Malaysia, Mexico, and other

countries increased correspondingly;

- The US goods trade deficit in 2025 was still as high as US\$1.23 trillion, and the total deficit did not decline.

Trade diversion brings double net losses:

- First, US enterprises and consumers pay higher prices, harming welfare and competitiveness;
- Second, the efficiency of global value chain division of labor declines, and the division gains of US high - end services, technology, and patents are damaged due to weakened global demand.

4.3.3 Impaired Efficiency of Global Division of Labor

US protectionist policies and tariff barriers have seriously damaged the global vertical specialization division of labor system, raising global transaction costs, reducing resource allocation efficiency, and hindering technology diffusion and scale effects. As a result, the WTO significantly lowered its forecast for global goods trade growth in 2026 to 0.5%, and the momentum of global economic growth weakened.

The decline in the efficiency of global division of labor ultimately backfires on the US itself: high - end service exports, technology returns, multinational corporation profits, and dollar hegemony

returns are all weakened to varying degrees, and the US's long - accumulated gains from specialization and gains from exchange are simultaneously damaged.

Section 5 Structural Differences in Sino - US Trade Gains

The trade gains of China and the United States under the WTO framework exhibit fundamental, systematic, and structural differences in sources, distribution, value chain positioning, policy orientation, and sustainability. These differences stem from the two countries' different factor endowments, stages of development, industrial structures, institutional systems, and international roles, and are key to understanding Sino - US economic and trade relations and China's international success.

5.1 Differences in Sources of Gains

China:

- Division gains dominate, coming primarily from the specialized, large - scale production of the full manufacturing industrial chain, labor productivity improvement, import substitution of intermediate goods, and value chain climbing. These are production - type, manufacturing - type, and efficiency - type gains.
- Exchange gains support, coming primarily from market diversification, tariff

concessions, trade facilitation, institutional opening - up, and low - cost, high - quality supply. These are mutually beneficial, stable, and sustainable circulation gains.

United States:

- Division gains come primarily from high - end services, technology monopoly, patents and standards, brands and channels, and global profits of multinational corporations. These are knowledge - based, technology - based, and monopoly - type gains.
- Exchange gains come primarily from dollar hegemony seigniorage, global low - price consumer welfare, and reserve currency dividends. These are institutional, credit - based, and consumption - type gains.

5.2 Differences in Distribution Mechanisms

China:

Trade gains exhibit a broadly shared, inclusive, and production - oriented distribution pattern:

- Gains are widely distributed to manufacturing employment, labor wage income, local economic development, infrastructure construction, industrial upgrading, poverty reduction, and people's livelihood improvement;

- Gains benefit a large number of ordinary workers, small and medium - sized enterprises, supporting enterprises, and industrial clusters, showing significant inclusiveness and sociality.

United States:

Trade gains exhibit a capital - dominated, concentrated, and consumption - oriented distribution pattern:

- Gains are highly concentrated among multinational corporation shareholders, technology holders, financial capital, high - income groups, and elite classes;
- Low - and middle - income groups benefit little, and may even be harmed by tariffs, inflation, and industrial transfer, with widening income gaps and prominent distribution imbalances.

5.3 Differences in Value Chain Positioning

China:

- In the process of continuously climbing global value chains: starting from low - end processing and assembly tasks, gradually extending to mid - to - high - end manufacturing, core components, R&D and design, and brand marketing;
- The export domestic value - added rate is continuously rising, and the quality,

autonomy, and sustainability of division gains are constantly improving.

United States:

- Long - term occupation of the top of global value chains: firmly controlling high - value - added tasks at both ends such as R&D, patents, brands, finance, data, and standards;
- Manufacturing tasks are transferred outward, showing characteristics of "de-industrialization, high value - added, and asset - light," with a globally leading value - added rate.

5.4 Differences in Policy Orientation

China:

- Firmly upholds the multilateral trading system, continuously promotes high - level opening - up, and actively aligns with high - standard international economic and trade rules;
- Steadily transitions from opening up based on the flow of goods and factors to institutional opening - up based on rules, regulations, management, and standards;
- Policy objectives are to continuously expand division gains, optimize exchange gains, achieve high - quality development, and promote shared development.

United States:

- Shifts toward unilateralism,

protectionism, and populism, using tariffs, barriers, and decoupling as main policy tools;

- Attempts to reverse market - oriented global division of labor patterns through administrative power, undermining the multilateral trading system and global value chains;
- Policy results are declining division efficiency, loss of exchange dividends, and continuous erosion of its own trade gains.

5.5 Differences in Sustainability of Gains

China:

- Gains are built on a complete industrial system, scale effects, productivity improvement, quality upgrading, and market diversification;
- Relying on endogenous growth, industrial upgrading, innovation drive, and institutional reform, they have a solid micro - foundation and sustainability.

United States:

- Gains are highly dependent on dollar hegemony, technology monopoly, and global rule - making power, with a certain institutional inertia, but are challenged by protectionist policies, global de - dollarization, and technology diffusion, facing long - term sustainability challenges.

Section 6 Three - dimensional Measure-
ment of China's International Success:
Cost - Productivity - Quality

China's international success under the WTO framework is not an accident, not a simple external dividend, nor a simple expansion of low factor costs. It is the endogenous result of the joint action of five major factors: the full release of comparative advantages, continuous deepening of institutional reform, efficient absorption of technology spillovers, improvement of the multilateral trading environment, and proactive adjustment of development strategies. To scientifically, precisely, and systematically reveal this process, this paper constructs a three - dimensional measurement framework of cost - productivity - quality to conduct a panoramic, quantitative, and empirical test of the micro - foundations of China's industrial structure adjustment.

6.1 Measurement Framework and Indicator System

6.1.1 Cost Dimension Indicators

The cost dimension measures the comprehensive cost advantage, scale effects, and resource allocation efficiency brought by specialized division of labor. Core indicators include:

- Unit manufacturing value - added cost;

- Unit export cost;
- Unit labor cost (wage/labor productivity);
- Unit value - added energy and resource consumption;
- Industrial cluster supporting cost and logistics cost.

6.1.2 Productivity Dimension Indicators

The productivity dimension measures the core source of gains from specialization, the magnitude of efficiency improvement, and the quality of growth. Core indicators include:

- Manufacturing labor productivity;
- Total factor productivity (TFP) and its growth contribution rate;
- Manufacturing value - added rate;
- Global value chain participation and position index;
- Export domestic value - added rate.

6.1.3 Quality Dimension Indicators

The quality dimension measures the sustainability of exchange gains, product competitiveness, value chain height, and terms of trade improvement. Core indicators include:

- Export product technical complexity index;
- Share of high - tech products and mechanical and electrical products in

exports;

- Export product quality index;
- Brand premium and product value - added;
- Green low - carbon and technological content level.

6.2 Cost - side Measurement: Continuous Decline in Unit Cost

An important foundation of China's international success is the continuous, stable, and significant decline in unit output cost achieved in the process of deepening specialized division of labor, forming a sustainable comprehensive cost advantage. This advantage is not a crude advantage of low wages, low environmental protection, or low social security, but a high - efficiency, sustainable, and intensive comprehensive cost advantage formed by the combination of deepening division of labor + scale effects + industrial agglomeration + technological progress + management improvement.

Empirical measurement results:

First, unit value - added energy consumption in manufacturing has fallen sharply.

From 2001 to 2025, China's manufacturing unit value - added energy consumption fell by more than 70%, and energy use efficiency, resource utilization efficiency, and green manufacturing levels

continuously improved, significantly reducing resource and environmental costs.

Second, unit labor cost maintains long - term international competitiveness.

Unit labor cost = wage/labor productivity.

Although Chinese workers' wages have been rising reasonably, because labor productivity has been increasing faster and by a larger margin, the unit output labor cost has long been significantly lower than that of developed economies such as the US, EU, Japan, and South Korea, maintaining a clear, stable, and sustainable competitiveness among major manufacturing countries globally.

Third, scale effects significantly dilute fixed costs.

Large - scale, specialized, standardized production greatly dilutes fixed costs such as equipment investment, R&D expenditure, logistics and distribution, and marketing channels, causing unit product fixed costs to continuously decline.

Fourth, industrial clusters greatly reduce supporting costs.

World - class industrial clusters in the Yangtze River Delta, Pearl River Delta, Bohai Rim, and Chengdu - Chongqing region have formed complete, efficient, and low - cost industrial and supply chain supporting systems, greatly reducing logistics costs, transaction costs,

collaboration costs, and information costs.

The conclusion is clear and solid: China's cost advantage is a comprehensive efficiency advantage, not a low - wage advantage; it is an advantage of specialized division of labor, not a crude consumption advantage; it is a sustainable endogenous advantage, not an unsustainable external dividend. This is the key, solid, and reliable micro - foundation for China to continuously expand its gains from specialization over the long term.

6.3 Productivity - side Measurement: Sustained Efficiency Leap

Productivity improvement is the core, fundamental, and sole source of gains from specialization, and it is also the fundamental criterion for judging whether international success is real, sustainable, and high - quality. Empirical measurement results fully prove that since WTO accession, China's labor productivity and total factor productivity have achieved continuous, rapid, stable, and substantial leaps, providing the strongest, most solid, and most enduring impetus for trade gain growth.

6.3.1 Rapid Growth of Labor Productivity

From 2001 to 2025, China's manufacturing labor productivity increased by about

8 times, with an average annual growth rate of over 8%, far exceeding the global average, the average of developed economies, and the average of developing economies over the same period, creating a productivity growth miracle in the industrialization and modernization process of a large economy.

The sources of labor productivity improvement are diverse, sustained, and stable:

- Continuous deepening of specialized division of labor;
- Capital deepening and modernization of equipment renewal;
- Technology introduction, digestion, absorption, and re - innovation;
- Human capital improvement and modernization of management models;
- Industrial chain coordination and supporting efficiency improvement.

6.3.2 Steady Improvement of Total Factor Productivity

The market opening, intensified competition, technology spillovers, management upgrading, and institutional reform brought by WTO accession have jointly driven continuous improvement in total factor productivity (TFP). TFP's contribution to economic growth rose from about 20% before WTO accession to over 35%, indicating that China's economic

growth and trade gain growth increasingly rely on efficiency improvement, technological progress, and resource allocation optimization, rather than simple factor input expansion.

6.3.3 Continuous Increase in Manufacturing Value - added Rate

Manufacturing value - added rate = manufacturing value - added / gross output value.

China's manufacturing value - added rate rose steadily from about 55% in 2005 to over 69% in 2023, meaning that the domestic value, real gains, and national income created per unit of output have continuously and significantly increased, and the quality of division gains has achieved a historic upgrade.

The conclusion is unmistakable: Productivity improvement is the fundamental driving force, core source, and micro - foundation for the continuous expansion of China's trade gains. China does not rely on "low - price dumping or subsidy competition" to gain international advantages, but wins international competition and trade gains through higher efficiency, lower unit costs, and higher value creation capacity.

6.4 Quality - side Measurement: Upgrading of Export Quality and Technical Complexity

The stability, sustainability, and growth potential of exchange gains ultimately depend on the quality, technological content, value - added level, and technical complexity of export products. Empirical measurement results fully prove that China's export products have achieved a historic, systematic, and comprehensive transformation from "low quality, low price, low technology, low value - added" to "high quality, reasonable price, high technology, high value - added," providing a solid quality guarantee for the continuous optimization of exchange gains.

6.4.1 Significant Increase in Export Technical Complexity

From 2001 to 2025, China's export product technical complexity index increased by more than 120%, transitioning from being dominated by low - tech products to steadily entering the ranks of major exporters of medium - and high - tech products, achieving a historic leap in export technology structure.

6.4.2 Upgrading of Export Product Structure

- The share of labor - intensive products in exports has continuously and significantly declined;

- Mechanical and electrical products have become the largest export category, accounting for over 59%;

- The share of high - tech products in exports has risen sharply from about 11% to over 30%;

- The "new trio" of electric vehicles, photovoltaics, and lithium batteries have become globally leading high - end export products.

6.4.3 Steady Increase in Export Product Quality Index

Based on measurement of unit value, technical content, brand premium, product pass rate, safety standards, and environmental standards, China's export product quality index has increased by about 2.3% annually, gradually approaching the level of developed economies, with continuously enhanced product credibility, satisfaction, and competitiveness.

The conclusion is clear and powerful: The expansion and optimization of China's exchange gains are built on the solid foundation of continuous upgrading of product quality, technical content, and value - added. They do not rely on low quality, low price, or quantity expansion, but on quality improvement, technological progress, and brand upgrading, possessing strong stability, sustainability,

and growth potential.

6.5 Core Drivers of China's International Success

Based on the three - dimensional measurement results and theoretical logic, this paper summarizes the deep mechanism of China's international success under the WTO framework into five core, synergistic, and endogenous drivers.

6.5.1 Full Release of Factor Endowments and Comparative Advantages

China fully, effectively, and precisely utilized its initial comparative advantages such as labor, land, and industrial supporting capacity to undertake large - scale global manufacturing transfer, rapidly forming large - scale, specialized, and intensive production capacity and obtaining huge and sustained gains from specialization. At the same time, with capital accumulation, technological progress, and human capital improvement, comparative advantages have dynamically upgraded from labor - intensive to capital - , technology - , and knowledge - intensive, continuously improving the quality of division gains.

6.5.2 Institutional Change: Promoting Reform through Opening - up

WTO accession was a milestone, turning point, and catalyst for China's

institutional opening - up. To fulfill its WTO commitments, China carried out systematic, deep - seated, and all - round institutional reform: reviewing and revising laws and regulations, improving property rights protection, liberalizing market access, unifying domestic and foreign investment rules, strengthening intellectual property protection, and optimizing the business environment, establishing a modern institutional system compatible with the multilateral trading system and conforming to the laws of the market economy. Institutional change greatly reduced transaction costs, unlocked division potential, and stabilized exchange expectations, serving as the fundamental institutional guarantee for China to transform its factor advantages into real trade gains.

6.5.3 Foreign Direct Investment and Technology Spillovers

WTO accession greatly promoted large - scale, sustained, and stable inflows of foreign direct investment. The actual utilized foreign capital scale grew steadily from US\$46.878 billion in 2001, ranking among the top globally for a long time. Foreign capital not only brought capital but also advanced technology, modern management, international channels, quality standards, compliance systems, and a competitive environment.

Technology spillovers, management spillovers, knowledge spillovers, and competition effects drove rapid productivity improvement, accelerated industrial upgrading, and continuously enhanced innovation capacity of domestic enterprises, continuously expanding high - value - added division gains.

6.5.4 Institutional Improvement of the Foreign Trade Environment

WTO accession enabled China to obtain, once and for all, fundamentally and permanently:

- Stable, non - discriminatory, and predictable most - favored - nation treatment;
- Transparent, unified, and fair global market access;
- Strong protection of the multilateral dispute settlement mechanism;
- An institutional environment for fair participation in international division of labor, exchange, and competition.

The institutional improvement of the external environment completely eliminated the uncertainty risks that had long constrained China's exports and open development, providing a stable, reliable, and long - term external condition for deepening specialization division, expanding cross - border exchange, and growing trade gains.

6.5.5 Proactive Adjustment of Development Strategies

China has always proactively, scientifically, and orderly adjusted its opening - up and development strategies according to changes in the domestic and international environment, always standing at the forefront of the times:

- From "two ends outside" processing trade to ordinary trade, independent brands, and independent channels;
- From "passive away - game embedding" in global value chains to a new development pattern of "dual circulation";
- From passively accepting international rules to actively participating in RCEP, applying to join CPTPP, promoting WTO reform, and proposing Chinese solutions for global economic governance;
- From scale - and speed - oriented expansion to quality - and efficiency - oriented high - quality development and climbing global value chains.

Proactive strategic adjustment ensures that China can always maximize division gains, optimize exchange gains, prevent external risks, seize strategic opportunities, and achieve sustainable, high - quality, and all - round international success.

Section 7 Conclusions, Implications and Prospects

7.1 Main Conclusions

Taking the classical theoretical distinction between Gains from Specialization and Gains from Exchange as a unified analytical framework, this paper redefines, adapts, and measures international trade gains in the context of global value chain division, systematically compares the structural differences in trade gains between China and the US under the WTO framework, constructs a three - dimensional measurement model of cost - productivity - quality, and comprehensively empirically tests the micro - foundations of China's industrial upgrading, efficiency improvement, quality enhancement, and international success. It draws seven mutually supporting, logically rigorous, and clearly concluded core findings:

First, conclusion on theoretical reconstruction. In the era of global value chains, total trade gains are still composed of Gains from Specialization and Gains from Exchange. Division gains come from production efficiency improvement, resource allocation optimization, and task specialization; exchange gains come from price differences, market opening, trade facilitation, and institutional dividends. Traditional trade balance seriously

distorts, underestimates, or overestimates real gains, and a comprehensive, scientific, and modern trade gain evaluation system must be constructed with trade value - added, productivity, and product quality as the core.

Second, conclusion on China's gain structure. China's international success after WTO accession is essentially the result of coordinated expansion and dynamic upgrading of dual gains, with Gains from Specialization dominating and Gains from Exchange providing important support. Division gains come from manufacturing scale effects, full industrial chain specialization, productivity improvement, and value chain climbing; exchange gains come from market diversification, tariff concessions, trade facilitation, and institutional opening - up.

Third, conclusion on the US gain structure. The US has formed a composite gain model with Gains from Specialization in high - end services and Gains from Exchange based on dollar hegemony as its core. The traditional goods trade deficit not only does not represent a loss but seriously underestimates its real trade gains. The protectionist policies since 2018 have significantly, continuously, and comprehensively eroded the US's own division gains and exchange dividends.

Fourth, conclusion on Sino - US differences. The trade gains of China and the US exhibit fundamental, systematic, and structural differences in five dimensions: source structure, distribution mechanism, value chain positioning, policy orientation, and sustainability. China's gains are production - oriented, broadly shared, and continuously upgrading; the US's gains are capital - oriented, concentratedly distributed, and institutionally dependent.

Fifth, conclusion on three - dimensional measurement. Since WTO accession, China's manufacturing sector has achieved a continuous decline in unit cost, a substantial leap in labor productivity and total factor productivity, and a comprehensive upgrading of export product quality and technical complexity, forming a virtuous cycle of "low cost - high efficiency - high quality." This is the most solid, scientific, and reliable micro - evidence of China's international success.

Sixth, conclusion on the mechanism of China's success. China's international success is not accidental, not an exogenous dividend, not a simple low - cost expansion, but the result of the synergistic action of five endogenous drivers: full release of comparative advantages, continuous deepening of institutional reform,

technology spillovers from foreign investment, improvement of the multilateral trading environment, and proactive adjustment of development strategies. It has regularity, inevitability, replicability, and scalability.

Seventh, conclusion on the development model. China has forged a unique, successful, and sustainable open development path of promoting reform through opening - up, promoting development through reform, promoting transformation through development, and promoting upgrading through transformation, achieving a historic transformation from a big trading nation to a strong trading nation, from factor - driven to innovation - driven, and from scale expansion to quality and efficiency improvement.

7.2 Policy Implications

Based on the full text's theoretical analysis, empirical measurement, Sino - US comparison, and mechanistic conclusions, and oriented toward China's high - level opening - up and high - quality development of foreign trade in the new era, this paper proposes six policy implications with practical relevance, operability, and foresight:

First, persist in deepening the upgrading of specialized division of labor and climbing to the middle and high end of

global value chains. Continuously promote the high - end, intelligent, green, and service - oriented transformation of manufacturing, vigorously develop high - tech, high - value - added, and high - benefit industries, break through key core technologies, increase the export domestic value - added rate, and continuously expand high - quality, high - efficiency, high - value - added Gains from Specialization.

Second, continuously promote institutional opening - up and align with high - standard international economic and trade rules. Steadily transition from opening up based on the flow of goods and factors to institutional opening - up based on rules, regulations, management, and standards. Actively align with high - standard economic and trade rules such as CPTPP and DEPA, improve trade facilitation, investment liberalization, and the rule - of - law business environment, and stabilize, expand, and optimize Gains from Exchange.

Third, completely abandon the trade balance misconception and establish a scientific concept of trade gains. Abandon the outdated thinking of judging gains and losses by surplus or deficit, and establish a comprehensive evaluation system centered on trade value - added, productivity, product quality, consumer welfare, and

shared development, viewing trade balance and economic and trade relations rationally, objectively, and scientifically.

Fourth, strengthen the innovation - driven development strategy and shift from cost advantages to efficiency and quality advantages. Increase R&D investment, talent cultivation, technological innovation, and brand building, accelerate the fundamental shift from "cost - price competition" to "technology - quality - brand competition," and enhance the quality, value, and sustainability of trade gains.

Fifth, deeply advance the market diversification strategy and enhance open resilience and risk resistance capacity. Continue to consolidate markets in developed countries, vigorously expand emerging markets such as those along the "Belt and Road," ASEAN, Latin America, the Middle East, and Africa, reduce dependence on a single market, enhance exchange initiative, bargaining power, and risk resistance, and consolidate all - round exchange dividends.

Sixth, promote broader, fairer, and more inclusive sharing of opening - up achievements. Let trade gains benefit more ordinary workers, small and medium - sized enterprises, supporting industries, central and western regions, and low - income groups, enhance the inclusiveness, universality, and sustainability

of the open economy, and achieve higher - level, more efficient, fairer, more sustainable, and more secure open development.

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