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Abstract

The theory of comparative advantage provides important guidance for the industrialization of late-developing economies and has supported China in building a complete industrial system based on factor endowments. However, against the backdrop of adjustments in the geopolitical landscape and the fading of factor dividends, the static endowment paradigm is prone to problems such as path lock-in and capture at the low end of the value chain. As industrial competition is currently shifting toward systemic confrontation among industrial ecosystems, this paper proposes a theory of combinatorial advantage, moving beyond the logic of linear addition of factors and relying on the coupled symbiosis of heterogeneous factors to generate systemic emergent effects. The paper reflects on the boundaries of comparative advantage theory, constructs an analytical framework for combinatorial advantage, conducts an empirical examination of the Yangtze River Delta new energy vehicle cluster, and clarifies the iterative logic of the two paradigms. The study shows that comparative advantage is suited to the emergence of industries "from zero to one," while combinatorial advantage supports industries in moving "from large to strong." In the new stage, the key to industrial upgrading lies in proactively cultivating dynamic and sustainable industrial combinatorial advantages.

Full Text

Industrial Development: From Comparative Advantage to Combinatorial Advantage

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Abstract: Comparative advantage theory has provided important guidance for the industrialization of late-developing economies, supporting China' s construction of a complete industrial system based on factor endowments. However, against the backdrop of adjustments in the geopolitical landscape and the diminishing dividends of factors, the static endowment paradigm is prone to problems such as path lock-in and capture at the low end of the value chain. As industrial competition is now shifting toward systemic rivalry among industrial ecosystems, this paper proposes a theory of combinatorial advantage, breaking through the linear-additive thinking of factors and relying on the symbiotic coupling of heterogeneous factors to induce system-emergence effects. The article reflects on the boundaries of comparative advantage theory, constructs an analytical framework for combinatorial advantage, and uses the development experience of the Yangtze River Delta new-energy vehicle cluster for empirical examination, clarifying the iterative logic of the two paradigms. The study shows that comparative advantage enables industries to move "from nothing to something," while combinatorial advantage supports industries in moving "from

large to strong" ; the key to industrial upgrading in the new stage lies in proactively cultivating dynamic and sustainable industrial combinatorial advantages.

Keywords: comparative advantage; combinatorial advantage; industrial paradigm; new quality productive forces

I. Introduction

Within the genealogy of modern economic thought, comparative advantage theory is the most influential analytical framework for interpreting the international division of labor. Ricardo (1817) demonstrated through a two-country, two-commodity model that even if an economy lacks any absolute production advantage, specializing in division of labor and free trade based on differences in relative production costs can still enhance the overall welfare of both sides. Heckscher and Ohlin further attributed the origin of comparative advantage to differences in the stock of innate factors, establishing factor endowment theory (the H-O model) and completing the theoretical closure of a static international division-of-labor system (Heckscher, 1919; Ohlin, 1933). This theory emerged in an era of free-competition industry characterized by slow cross-border factor flows, short industrial chains, and clear industrial boundaries. Its rigorous assumptions were temporarily compatible with the limited economic realities of the time, and it therefore possessed staged explanatory power and policy reference value.

For late-developing economies, comparative advantage offered an industrialization path with relatively low thresholds. Regions without

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There is no need to pursue the completeness of industrial categories, nor to make up all factor shortcomings in the short term; it is only necessary to concentrate resources on developing industries that fit the relatively abundant local factors, and to rely on outward-oriented specialization to achieve the gradual accumulation of capital, technology, and management experience. China' s rapid industrialization over the past forty-plus years has been precisely a grand natural testing ground for the theory of comparative advantage. Relying on a combination of an extraordinarily large labor supply, abundant land factors, and outward-oriented policies, China undertook the echelon transfer of global manufacturing, grew into the "world' s factory," and achieved long-term economic growth with the scale effects of specialized division of labor. In fairness,

had the comparative advantage embedded in static factors not been fully unleashed, it would have been difficult for China to build a complete industrial foundation within just a few decades. The most representative example is the new structural economics proposed in 2011 by the Chinese scholar Justin Yifu Lin. This theory holds that the industrial and technological structure of an economy at each point in time is endogenous to the factor endowment structure given at that point in time; the factor endowment structure is the starting point of economic analysis and determines the comparative advantage of the economy (Lin Yifu, 2011; Lin Yifu and Cai Hui, 2022).

Yet every economic theory has a clearly defined scope of application. Once divorced from its premises, the conclusions derived from theory no longer hold. For a long time, mainstream economics has continuously sanctified comparative advantage, elevating the pattern of stage-based division of labor into a universal iron law of development, while deliberately obscuring its internal theoretical defects and the distributional bias in global division of labor. Whether in the classical comparative-advantage model of Ricardo or in the Heckscher–Ohlin factor endowment framework, both are built upon a set of idealized constraints far removed from contemporary reality: factors cannot flow freely across borders; technological levels are exogenously fixed; returns to scale in production are constant; markets are in a state of perfect competition; there are no monopoly forces; transport costs and institutional frictions are ignored; and the pattern of international division of labor remains in long-run equilibrium and stability. In today' s world, all of the above preconditions are undergoing systemic dissolution: the tide of deglobalization continues to surge; technological rivalry among major powers grows increasingly intense; global supply chains are accelerating their regionalized and localized restructuring; digital technologies and green technologies are continuously reshaping the organizational forms of industries; and the traditional logic of division of labor built upon a stable globalized environment is steadily losing efficacy. The development experiences of various countries repeatedly warn that clinging for a long time to static comparative advantage very easily leads into a "comparative-advantage trap" : economies become persistently locked into low-value-added processing stages, and their endogenous momentum for innovation gradually declines; once the factor dividend disappears, manufacturing migrates outward, and the risk of industrial hollowing-out immediately appears. The center–periphery theory put forward by Prebisch and Singer long ago revealed that, within an unequal global value-chain system, relying solely on primary factor endowments to participate in the international division of labor will continuously worsen the terms of trade of late-developing countries and form a hierarchical pattern of division of labor in which the strong remain strong and the weak become solidified in weakness.

Returning to China' s domestic reality, the growth momentum driven by traditional factors is continuously weakening. Labor costs are rising, constraints on land resources are tightening, and the international competitiveness of low-end manufacturing is gradually diminishing. Even more worthy of vigilance is that endowment-based thinking has formed

path dependency: many local industrial-planning bureaus are constrained by the idea that "whatever resources one has determines what industries one develops," leading to homogeneous investment attraction across regions, low-level involution, fragmentation among various factors, insufficient upstream–downstream linkage, and difficulty in generating cluster-based collaborative forces. In the face of technological blockades and supply-chain disruptions, advantages in single factors cannot build an effective industrial security shield.

Changes in the times call for theoretical innovation. The unit of competition has shifted from single points to complex systems, requiring the construction of an entirely new analytical framework: one that both acknowledges the foundational role of comparative advantage in the initial stage of industrialization and rationally identifies its theoretical shortcomings, while effectively explaining new economic phenomena such as industrial integration, cluster symbiosis, and ecological competition. Comparative advantage answers "which endowment should be relied upon to participate in market competition," pursuing optimal production efficiency in a single link; combinatorial advantage answers "how diverse factors can be recombined to shape unique, irreplaceable system capabilities," pursuing the emergence of overall efficiency. The main thread in the history of high-quality industrial development is precisely the completion of a paradigm shift from passive reliance on static comparative advantages to the active cultivation of dynamic combinatorial advantages. This paper systematically critiques the inherent limitations of the traditional comparative-advantage paradigm, analyzes the theoretical distinctions between the two paradigms, explicates the operating mechanism of combinatorial advantage, and conducts experiential verification through typical industrial cases, thereby exploring feasible pathways for paradigm transformation.

The possible innovations of this paper are as follows. First, it breaks through the limitations of the static endowment thinking of comparative-advantage theory, explicitly proposes the original analytical concept of combinatorial advantage, clarifies its core connotations and essential features, and expands the research horizon of industrial competition theory. Second, it reconstructs the analytical framework for industrial development, clarifying, from the three dimensions of development perspective, competition perspective, and global perspective, the logic of paradigm transformation from comparative advantage to combinatorial advantage, and provides a new theoretical perspective for interpreting the internal laws of industrial upgrading in the new stage of development. Third, oriented toward the practical needs of China' s high-quality industrial development, it proposes implementable practical pathways for cultivating industrial combinatorial advantages, providing theoretical reference for local industrial planning, industrial-cluster construction, and the cultivation of new quality productive forces.

II. Theoretical Enchantment: The Collapse of the Premises of Comparative Advantage and Reflection on Its Boundaries

(I) The Evolutionary Trajectory and Core Assumptions of Comparative-Advantage Theory

The development of comparative-advantage theory follows a static evolutionary path from "technological differences" to "endowment differences." Ricardo attributed differences in comparative costs to relative differences in production technologies among countries, but he assumed that technological levels remain unchanged over the long term; the Heckscher-Ohlin model further stripped away the technology variable and attributed the fundamental driving force of specialization to the endowments of factors of production.

Due to differences in the initial endowments of capital, labor, natural resources, and other factors across countries, it derives the theorem of factor-price equalization and constructs a complete static logic of division of labor. Later extensions of factor-endowment theory—such as the Rybczynski theorem and the Stolper-Samuelson theorem—still did not depart from the core framework that "exogenous endowments determine the structure of the division of labor."

The explanatory power of this theoretical system rests entirely on five core assumptions: first, factors are completely immobile across countries and can move freely only within a country; second, production technology is exogenously given, with no innovation or technological diffusion; third, returns to scale are constant, and output changes in the same proportion as factor inputs; fourth, markets are perfectly competitive, with no monopoly or barriers to entry; fifth, industrial boundaries are clear, and the division of labor occurs only at the level of final products. It is precisely these assumptions that simplify a complex economic system into a deducible equilibrium model, while also laying the groundwork for the theory' s failure in reality.

(二) Systemic Failure of the Premises: From the Ideal Model to Divergence from Reality

Entering the twenty-first century, the deepening of globalization and the technological revolution have thoroughly shaken the theoretical foundation of comparative advantage, and the five assumptions have been successively overturned by reality.

First, the cross-border movement of factors has shifted from "impossible" to "normal." Cross-border capital, frontier technologies, and high-end talent can be rapidly allocated on a global scale. Capital can seek low-cost factors across regions, overturning from the bottom up the core logic that "endowments determine the division of labor." Even if a country lacks capital and technology, it can introduce factors through opening to the outside world; conversely, an advantage in labor costs may also be rapidly eroded by capital outflows.

Second, technology has changed from an exogenous constant into an endogenous variable. Endogenous growth theory has already demonstrated that R&D investment, learning by doing, and the accumulation of human capital can continuously drive technological progress; moreover, technological diffusion and spillovers under global value chains have further made technological level a dynamic factor that can be cultivated and shaped. Developing countries are not limited to passively adapting to the existing technological pattern; they can fully realize technological catch-up through proactive deployment.

Third, the assumption of constant returns to scale seriously diverges from the characteristics of modern industry. New energy, semiconductors, high-end equipment, and digital industries generally exhibit significant scale effects and network effects: the larger the production-capacity scale, the lower the unit cost; the larger the user scale, the higher the ecosystem value. The new trade theory pioneered by scholars such as Krugman has already shown that increasing returns to scale can become a driving force of international division of labor independently of factor endowments, posing a direct theoretical challenge to H-O theory; the Leontief paradox, at the empirical level, struck at the foundation of the factor-endowment doctrine—the exports of the capital-abundant United States were instead labor-intensive products, the exact opposite of the theory' s prediction.

Fourth, the assumption of perfect competition does not conform to the true market structure. The vast majority of industries worldwide are characterized by oligopolistic monopoly,

monopolistic competitive state; transnational enterprises rely on patents, standards, brands, and channels to construct persistent market barriers. Free and balanced division of labor is merely a theoretical conception. In an environment where monopolistic forces persist, machinery that follows comparative advantage to participate in the division of labor is highly liable to have its profit space continuously squeezed by international leaders.

Fifth, industrial boundaries have moved from clarity toward convergence. The division of labor in global value chains has shifted from a deepening inter-product division of labor to an intra-product division of labor: the R&D, production, assembly, and marketing of the same product are distributed across different countries. The traditional model of "one country producing one product" no longer exists, and both the measurement benchmarks and application scenarios of comparative advantage have undergone essential changes.

(III) Deep Theoretical Predicament: Static Thinking, Distributional Imbalance, and Path Lock-in

The failure of the premise assumptions gives rise to three structural contradictions that are difficult to overcome, and this is also the fundamental reason why the static comparative-advantage paradigm cannot lead sustained industrial upgrading.

First, the factor-endowment determinism induces rigid path dependence. Within the analytical framework of factor endowments, industrial choice is passively constrained by the stock of innate resources. Once a region forms a specialized industrial structure along the path of comparative advantage, capital, talent, and infrastructure continue to agglomerate toward particular industries; asset specificity keeps rising, and the costs of industrial transformation keep expanding. Local governance easily develops ossified thinking, treating historically formed factor conditions as the ceiling for long-term industrial development, lacking the strategic awareness to actively reconstruct factor structures and cultivate new types of competitive advantage.

Second, the assumption of factor substitution obscures the value of synergistic coexistence. The classical production function assumes by default that capital, labor, and land can substitute for one another, and that the optimal production model is to make full use of abundant factors and economize on scarce factors. This logic applies only to traditional industries with standardized processes and simple technological chains. Emerging industries generated by the new round of scientific and technological revolution, however, belong to multi-factor synergistic systems: the chip industry requires high-end research talent, precision production equipment, specialized experimental platforms, large-scale application scenarios, and supporting coordination across a complete industrial chain. A single source of cheap labor or natural resources cannot generate industrial competitiveness. Factor relations have shifted from mutual substitution to complementary empowerment, creating a cognitive blind spot that traditional comparative-advantage theory can hardly cover.

Third, an extremely specialized division of labor undermines industrial resilience and distributive fairness. Comparative advantage advocates that countries deeply cultivate a single, finely segmented link in the industrial chain and pursue the maximization of specialized efficiency. In the short term, division of labor can enhance local production efficiency; in the long run, however, the price is a highly fragmented industrial chain and a weakened system. Under conditions of geopolitical conflict and frequent trade barriers, a supply shock in a single link can be transmitted along the network to the entire industrial system. A deeper contradiction lies in the fact that the theory only demonstrates that division of labor can expand total global welfare, while avoiding discussion of the welfare distribution pattern, thereby concealing the center–periphery

an unequal relationship in the group system: developed countries occupy high-rent links such as R&D, standards, and brands, while late-developing economies undertake energy-intensive, low-profit processing and manufacturing links, ultimately inducing late-developing countries to voluntarily accept low-end lock-in within the value chain.

The boundary of critique must be clearly defined: this article does not categorically deny the historical role of comparative advantage. In the early stage of industrialization, relying on local endowments to complete initial capital accumulation has practical rationality; the core object of critique is the doctrinization

of stage-based theory and its absolutization—directly elevating the principle of static division of labor into a long-term national development strategy. When an economy crosses beyond the initial stage of industrialization, continuing to cling to a comparative-advantage strategy will continuously magnify the theory' s inherent defects and lead to multiple development traps.

III. Paradigm Reconstruction: The Theoretical Construction and Operating Mechanism of Combinatorial Advantage

(I) The Core Connotation and Conceptual Boundaries of Combinatorial Advantage

First, key cognitive misconceptions must be clarified: **combinatorial advantage is by no means the simple addition of multiple comparative advantages, nor is it the stacking and patchwork of various resource elements.** Combinatorial advantage is a systemic competitive advantage that, relying on institutional architecture, industrial-chain organization, spatial layout, and innovation mechanisms, systematically reshapes heterogeneous technologies, production factors, market actors, infrastructure, and application scenarios, promotes deep coupling and complementary symbiosis among elements, and ultimately forms an advantage that no single element can independently generate and that external actors find difficult to replicate. Its core operating mechanism is coupled emergence: the recombination of elements gives rise to new structures, functions, and value, enabling the system' s comprehensive competitiveness to exceed the sum of the competitiveness of all independent elements.

Combinatorial advantage has clear distinctions from existing related theories and displays distinct originality. First, it differs from Porter' s theory of national competitive advantage: the diamond model emphasizes the interaction among four major elements within a single country/region—factor conditions, demand conditions, related industries, and firm strategy—essentially constituting a multidimensional extension of comparative advantage (Porter, 1990); by contrast, combinatorial advantage places greater emphasis on the deep coupling of heterogeneous elements across regions and across actors, highlights systemic emergence, and at the same time incorporates industrial-chain security and institutional coordination into the core framework, responding to new propositions of industrial competition in the new era. Second, it differs from general industrial-cluster theory: cluster theory emphasizes external economies of scale and knowledge spillovers brought about by geographic agglomeration; combinatorial advantage not only includes spatial agglomeration effects, but also encompasses deeper logics such as factor-structure reconstruction, empowerment by institutional mechanisms, and dynamic evolutionary iteration, making it applicable to cross-regional industrial networks and innovat···

more complex competitive units such as new ecosystems. Third, it differs from

the theory of dynamic comparative advantage: dynamic comparative advantage still does not break away from the logic that "endowment evolution determines the division of labor" ; it merely replaces static endowment with dynamic endowment. Combinatorial advantage, by contrast, fundamentally transcends "endowment determinism," emphasizing active construction and systemic recombination. Competitive advantage is no longer the passive result of endowment evolution, but rather the product actively shaped by agents.

The core differences between the two paradigms may be summarized as follows: comparative advantage belongs to point-based advantage, static advantage, passive endowment advantage, and factor-independent advantage; combinatorial advantage belongs to systemic advantage, dynamic advantage, actively constructed advantage, and factor-symbiotic advantage. The carrier of comparative advantage may be a single enterprise or a single administrative region; the carrier of combinatorial advantage is more often manifested as an industrial cluster, a cross-regional industrial network, or a complete industrial ecosystem. Comparative advantage relies on innate endowments and emerges naturally; combinatorial advantage is rooted both in existing local endowments and in openness to the outside world to absorb factors, institutional reform to remedy shortcomings, and technological innovation to cultivate new factors, and therefore possesses extremely strong proactive plasticity.

(II) The Four Essential Characteristics of Combinatorial Advantage

Industrial combinatorial advantage has four irreplaceable essential characteristics, which together construct its deep-level competitive barriers.

First, dynamic constructability. Innate factor endowments are merely the raw materials for factor combination, not a permanent constraint on industrial development. Even where a region has significant factor shortcomings, it can still, through openness to the outside world, absorb external high-end factors; through institutional reform, break factor constraints; and through technological innovation, cultivate new types of factors. Various shortcomings can be compensated for in the process of systemic coordination, while the value of strengths is continuously amplified. China' s complete industrial system provides a typical illustration: the advantage of labor cost alone has continued to decline, yet complete upstream and downstream supporting capacity, an ultra-large-scale domestic demand market, a multilevel engineering-talent echelon, and sustained innovation investment have become coupled with one another, forming a manufacturing ecosystem that is difficult for other countries to replicate.

Second, the coupled symbiosis of multiple factors. Capital, labor, technology, data, market space, and the business environment are no longer isolated from one another. Data factors empower traditional manufacturing equipment; a vast domestic demand market provides large-scale experimental scenarios for frontier technologies; and industrial clusters continuously reduce innovation costs and

circulation costs. Various factors form a positive cycle: the upgrading of a single factor drives the enhancement of the value of other factors, thereby constructing a feedback loop of continuous self-reinforcement. This coupling relationship is not a simple "1+1=2," but generates new systemic functions through nonlinear effects.

Third, high barriers and difficulty of replication. Point-based factor advantages are extremely easy to imitate: lower labor costs, land-preference policies, and the like can be rapidly replicated by other regions. However, an industrial collaborative ecosystem formed through long-term integration—including stable networks of inter-firm collaboration, trust relationships between supply and demand, a specialized talent pool, tacit industrial knowledge, and regional industrial culture—cannot be simply transplanted and replicated through short-term investment promotion and capital attraction; it builds a deep-level competitive moat.

Fourth, it accommodates the dual goals of efficiency and security. Extreme specialization and division of labor gives priority to short-term efficiency, while sacrificing systemic resilience; the blind pursuit of autonomous deployment across the entire industrial chain can easily lead to resource dispersion and efficiency losses. Combinatorial advantage achieves an effective balance between the two: relying on division of labor along the industrial chain to ensure production efficiency, relying on diversified supporting networks to hedge against external shocks, and coordinating industrial market competitiveness with industrial-chain security.

IV. Empirical Verification: The Practice of Combinatorial Advantage in the Yangtze River Delta New-Energy Vehicle Industrial Cluster

The Yangtze River Delta new-energy vehicle industrial cluster fully illustrates the evolutionary process from dispersed comparative advantage to systemic combinatorial advantage. It intuitively confirms the intrinsic characteristics of combinatorial advantage, while also reflecting the limitations of a division-of-labor model based solely on comparative advantage.

From the perspective of initial endowments, the four provinces and municipalities each possessed their own point-specific comparative advantages: Shanghai had advantages in high-end R&D talent, financial capital, complete-vehicle brands, and intelligent-chip R&D; Jiangsu had accumulated production-capacity advantages in power batteries and precision component manufacturing; Zhejiang had built up strengths in intelligent sensing, large integrated die casting, and digital production services; Anhui possessed complete-vehicle manufacturing bases, ample industrial space, and abundant road-testing scenarios. If each locality had adhered to the traditional endowment-based mode of thinking, strictly delineated industrial boundaries according to its own comparative advantages, and competed with one another for project resources, the ultimate result would

merely have been mutually fragmented and scattered production capacity. Each locality would have been confined to a single manufacturing link, making it difficult to carry out collaborative innovation, impossible to form global industrial competitiveness, and prone to falling into a regional "comparative-advantage trap."

With the deepening of integration in the Yangtze River Delta, cross-regional administrative barriers have continued to dissolve. Localities have moved beyond the endowment-based thinking of a single administrative district, promoted the cross-regional recombination and coupling of differentiated advantage factors, and jointly constructed combinatorial advantage at the regional level. Shanghai focuses on original innovation in frontier algorithms and autonomous-driving chips, assuming the "brain" function; Liyang' s power batteries, Ningbo' s integrated die casting, and Suzhou's automotive electronics form a stable supporting supply system, constituting the "trunk"support; Hefei undertakes the large-scale assembly of complete vehicles, putting the "four limbs" in place. Together, they have built the globally renowned Yangtze River Delta "four-hour auto-parts industrial circle." Various elements circulate freely, regional weaknesses compensate for one another, and strengths empower one another, generating spillover effects that no single province or municipality could achieve independently: logistics costs for components are lower than under a dispersed layout; the iteration cycle from R&D to mass production for new technologies is shortened; and in the face of raw-material price fluctuations and overseas trade frictions, the shock-resistance capacity of the entire industrial cluster is far higher than that of independently organized local industrial chains.

This industrial ecosystem is highly difficult to replicate. Other regions may introduce various preferential policies and quickly

rapidly put in place power-battery plants and vehicle production lines; yet comparative advantages at the level of single factors, however complex, cannot in the short term reproduce the enterprise collaboration networks, cross-regional innovation-coordination mechanisms, and multi-tier supporting industrial clusters that have taken dozens of years to accumulate in the Yangtze River Delta. The case clearly shows that comparative advantage can support only breakthroughs at single industrial points. Only by promoting the systematic coupling of diversified endowment factors and building a dynamically evolving symbiotic industrial ecosystem can a combinatorial advantage be constructed that is difficult to imitate and that combines both efficiency and resilience.

(三) The evolutionary mechanism of combinatorial advantage: from factor inventory to systemic emergence

The formation of combinatorial advantage does not happen overnight; rather, it follows a progressive evolutionary mechanism that may be divided into five sequentially connected stages.

The first step is the stage of identifying endowments. This involves a comprehensive inventory of all types of comparative-advantage resources inside and

outside the region; distinguishing between long-term factors and development-constraining conditions; clarifying the boundaries between immobile and mobile factors, and between traditional and new factors; and providing the foundational materials for subsequent combination.

The second step is the stage of removing barriers. Factor islands must be broken up, and three types of barriers—administrative, market, and informational—must be eliminated. Channels for factor circulation should be opened so that all types of factors can flow freely and be allocated flexibly, thereby creating institutional conditions for factor recombination.

The third step is the stage of building carriers. Relying on industrial clusters, innovation platforms, and industrial-chain alliances, collaborative carriers should be constructed to promote upstream–downstream linkage and deep integration among industry, universities, and research institutes, enabling dispersed factors to find concrete anchors for combination and thus move from physical aggregation toward chemical reaction.

The fourth step is the stage of structural iteration. Relying on institutional and technological innovation, the modes of factor matching should be continuously adjusted, and the combinatorial structure should be dynamically optimized in response to technological change and market demand, so as to avoid the formation of new path dependence.

The fifth step is the stage of systemic emergence. Long-term, stable collaboration gives rise to an emergent effect, forming a sustainable industrial-system competitiveness with the capacity for self-evolution. At this point, combinatorial advantage enters a mature and stable state, capable of self-reinforcement and self-iteration.

(四)Paradigm inheritance and transcendence: comparative advantage is the starting point; combinatorial advantage is the dimensional upgrade

Advocating the cultivation of combinatorial advantage by no means represents a wholesale negation of the theory of comparative advantage. The two are not binary opposites; rather, they constitute a theoretical genealogy in which different stages of industrial evolution advance layer by layer and are successively upgraded.

Comparative advantage is the micro-foundation and starting condition of industrial development. In the industrial development of any region, the resources that can first be mobilized are its localized, differentiated endowments. Attempting to build an industrial ecosystem divorced from realistic endowment conditions violates the laws of economic operation.

The basic law is that it is extremely easy to trigger blind investment attraction, industrial hollowing-out, and resource misallocation. Effective factor combination presupposes fully releasing the potential of various point-specific comparative advantages; differentiated endowments are precisely the basic materials that provide the foundation for systemic combination. Without dispersed and

diverse comparative advantages, combinatorial advantage becomes water without a source and a tree without roots.

The development goals of the two are essentially distinct: relying on comparative advantage pursues the maximization of point-specific specialized efficiency; cultivating combinatorial advantage aims to integrate scattered advantages, reconstruct system structures, and raise dimensions to form overall competitiveness. Figuratively speaking, various comparative advantages are like independent parts, while combinatorial advantage is a set of organic systems capable of continuous operation and self-iteration. Parts are indispensable, but scattered parts cannot generate complete system functions. The path of industrial upgrading is clearly visible: relying on comparative advantages completes the initial step of an industry from nothing to something; when the dividends of single factors reach their ceiling, factor integration and chain collaboration are advanced, realizing a shift from point-specific advantages toward systemic combinatorial advantages, and driving industries to climb continuously toward the high end of the value chain.

V. Logical Leap: The Triple Paradigm Shift from Comparative Advantage to Combinatorial Advantage

The shift from relying on static comparative advantage to proactively shaping dynamic combinatorial advantage is not merely an iteration of concepts, but a systemic reshaping of the underlying thinking of industrial development, concentrated in three fundamental logical transformations.

(I) Development Perspective: From Endowment Determinism to Capability-Construction Theory

The comparative-advantage paradigm adheres to endowment determinism: the upper limit of industrial development is locked in by the initial stock of factors, and policy thinking tends to conform to endowments and emphasize strengths while avoiding weaknesses. A large number of regional industrial plans are confined to the idea that "whatever resources the locality possesses determines what industries it develops," passively adapting to the external global division-of-labor pattern. In essence, this is a "fatalistic" view of development.

The combinatorial-advantage paradigm advocates capability-construction theory: innate endowment is only the starting point of development, by no means a permanent ceiling. Industrial competitiveness is no longer solidified in initial factor conditions; its core depends on the dynamic capability of factor recombination, resource integration, and ecosystem governance. Regional development no longer has only the single path of "conforming to endowments"; it can proactively aggregate external high-end factors, cultivate new types of factors such as data, scenarios, and innovative talent, break factor constraints through institutional reform, and actively create entirely new models of factor combination.

Numerous industrial-transformation practices at home and abroad have continuously verified this logic. Some cities once trapped by resource depletion have gradually lost their original comparative advantages in natural resources; by integrating science and education resources, cultivating digital industries, and optimizing the business environment, they have reconstructed factor ···

factor structures and incubate emerging industrial clusters; although the Yangtze River Delta and the Pearl River Delta do not possess advantages in energy or mineral resources, by continuously optimizing combinations of markets, talent, and industrial supporting systems, they have constantly nurtured new forms of high-end manufacturing and the digital economy. The shaping of dynamic capabilities means that the initiative for development returns to the regional actors themselves, thoroughly shaking off the long-term constraints of innate endowments.

(二)Shift in the View of Competition: From Single-Point Dislocated Competition to Synergistic Coexistence within Industrial Ecosystems

A division-of-labor system dominated by comparative advantage naturally guides regions toward dislocated competition and fragmented development. Each locality gives priority to developing industries in which it has a relative advantage, forming a regional division-of-labor pattern. In the early stage of industrialization, this model helps avoid redundant construction; if implemented over the long term, however, it easily leads to industrial fragmentation. Each locality acts on its own, cross-regional industrial-chain collaboration is insufficient, innovation resources compete with one another, and development falls into a low-level involution characterized by homogeneous investment attraction.

Combinatorial advantage advocates the logic of synergistic coexistence, with the competitive actors upgrading from a single enterprise or a single administrative region to cross-regional industrial ecosystems. Relations among regions are no longer only those of division-of-labor competition, but rather cooperative partnerships marked by complementarity among factors and linkage along chains. Core cities carry original innovation and headquarters economies, while surrounding cities undertake advanced manufacturing and supporting processing; leading enterprises and specialized, sophisticated, distinctive, and innovative small and medium-sized enterprises are mutually dependent, building symbiotic industrial clusters. Instead of one-sidedly pursuing a complete set of industrial categories within a single city, city clusters and metropolitan areas should promote coordinated factor allocation, connect innovation chains, industrial chains, capital chains, and talent chains, and form cross-regional combinatorial advantages.

Ecological synergy drives an upgrading of the competitive dimension. In the future, what industrial competition compares will no longer be the labor force or land prices of a single city, but the collaborative efficiency, supply–demand response speed, and innovation-conversion efficiency within the entire industrial

cluster. Isolated, single-point advantages are unable to contend with a mature industrial ecosystem operating in an integrated and coordinated manner.

(三) Shift in the Global View: From Passive Embedding in Value Chains to Active Shaping of Industrial Patterns

Following static comparative advantage to participate in the international division of labor, an economy can only accept the established allocation rules of global value chains. Developed countries occupy the two high-value-added ends of R&D and branding, while late-developing countries undertake the processing and manufacturing segments. If locked into this division-of-labor system for a long time, they can easily fall into low-end lock-in in the value chain; profit space is continuously squeezed; core components and key technologies are controlled by others. When the external environment is stable, growth is maintained by scale expansion; once technology blockades or trade restrictions are encountered, industrial development immediately suffers a huge shock.

When an economy cultivates a mature industrial combinatorial advantage, its global industrial positioning will undergo a qualitative change. Relying on complete industrial supporting systems, an ultra-large-scale domestic market, and a continuously iterative innovation ecosystem, it obtains stronger bargaining power in industrial chains. On the one hand, it relies on deep participation in global industrial collaboration through the industrial ecosystem; on the other hand, it conditionally cultivates indigenous ···

the main industrial chains, take the lead in subdivided technological standards, build a diversified supply-chain system, and reduce dependence on any single external source.

Behind this paradigmatic transformation lies the shift in the locus of development leadership. Under the comparative-advantage model, an economy adapts to the existing global division-of-labor order; under the combinatorial-advantage model, an economy possesses the capacity to participate in adjusting and shaping new patterns of industrial cooperation. This is precisely the core strategic demand for China to advance autonomous and controllable industrial chains and build a modern industrial system.

VI. Practical Approach: Path Choices for Cultivating Industrial Combinatorial Advantage

After clarifying the theoretical paradigm and critical logic, the foothold lies in exploring practical paths that can be implemented, and in advancing, in an orderly and gradual manner, localities' efforts to move beyond dependence on single factors, cultivate sustainable industrial combinatorial advantages, and align with the long-term strategic goal of developing new-quality productive forces. Based on the realities of domestic industries, this can be promoted systematically across five dimensions.

(I) Endowment Inventory: Consolidating the Combinatorial Foundation of Multiple Factors

Cultivating combinatorial advantage must never be detached from reality or built in the air. The primary task is to comprehensively inventory regional resource endowments, industrial foundations, talent reserves, market scale, and infrastructure, and to objectively identify local strengths and weaknesses. Traditional comparative advantages—such as abundant labor, land, distinctive resources, and traditional manufacturing—should be fully activated, thereby stabilizing the foundations of the real economy. At the same time, the potential of new types of factors should be tapped, with emphasis on new advantageous resources such as data factors, application scenarios, engineering capabilities, and tacit knowledge in industrial clusters.

When localities carry out industrial planning, they should abandon simple resource-oriented thinking and establish an analytical framework of "endowment inventory—advantage identification—factor recombination." They should distinguish between resources that can be used in the short term and potential advantages that can be cultivated over the medium and long term, as well as between immobile resources and mobile factors that can be absorbed across regions. On this basis, industrial directions should be determined; blind pursuit of fashionable tracks that are detached from the development foundation should be avoided, so as to prevent duplicated investment and resource waste. Existing single-point advantages should be fully activated to provide sufficient foundational materials for the systematic combination of factors.

(II) Breaking Barriers and Ensuring Flow: Smoothing the Circular Channels for Factor Coupling

Once factors are in a fragmented and isolated state, even if abundant advantageous resources are available, combinatorial effects cannot be generated. At present, the most prominent obstacles to cultivating combinatorial advantage are various tangible and intangible barriers: administrative fragmentation impedes cross-regional industrial layout; the flow of labor and capital markets is subject to institutional constraints; information among industry, universities, and research institutes is mutually isolated, making it difficult for scientific research achievements to be transformed into industrial applications.

To cultivate combinatorial advantage, the core direction of reform is therefore to smooth factor circulation. It is necessary to continue deepening market-oriented reform of factors,

Promote the free flow and optimized allocation of the five major factors—land, labor, capital, technology, and data. Break down local protectionism and market segmentation, advance the coordinated layout of industries across urban agglomerations, and establish a normalized cross-regional coordination mechanism. Build public information-service platforms, open up information channels between the innovation end and the industrial end, and accelerate the industri-

alization of scientific and technological achievements. Only when factors can be freely recombined and flexibly matched can the optimal mode of factor combination be continuously explored and the synergistic value of the system be released.

(III) Carrier Building: Using Industrial-Chain Clusters to Carry Synergistic Effects

Factor coupling does not arise spontaneously; it requires real carriers as its support. Industrial chains and modern industrial clusters are the most important platforms for nurturing combinatorial advantages. Industrial clusters naturally bring together upstream and downstream enterprises, production-service providers, talent, and logistics support, and possess the innate conditions for factor synergy. Chain-leading enterprises connect large, medium-sized, and small enterprises in series, form close industrial networks, and promote technology spillovers, experience sharing, and risk sharing.

Policy guidance needs to be adjusted appropriately: it should shift from supporting individual enterprises in isolation to cultivating complete industrial chains and strengthening innovative industrial clusters. Support should be given to chain-leading enterprises in playing their role in resource integration and driving the coordinated development of specialized, refined, distinctive, and innovative small and medium-sized enterprises; weak links in industrial chains should be remedied around strategic emerging industries, and the completeness and supporting capacity of industrial chains should be improved; traditional industrial clusters should be promoted to transform into innovative clusters, with laboratories, pilot-test bases, and public testing platforms laid out within clusters, so as to promote the deep integration of innovation activities and manufacturing activities. Relying on long-term interaction and integration within clusters, synergistic emergence effects can be continuously catalyzed.

(IV) Innovation-Driven Development: Iterating the Dynamic Structure of Factor Combinations

Combinatorial advantage is not static and fixed. Technological iteration and changes in market demand continuously alter the value weights of various factors. Several decades ago, labor and natural resources were core production factors; in the digital era, the value of technology, data, and application scenarios continues to rise. A fixed mode of factor combination will eventually and gradually become ineffective. To maintain the competitiveness of combinatorial advantage over the long term, it is necessary to rely on continuous innovation to dynamically optimize the structure.

Promote the two-way integration of the innovation chain and the industrial chain, and open up the complete chain from basic research, technological breakthroughs, and pilot-scale transformation to scaled production. Encourage enterprises to carry out technological upgrading and model innovation, transform traditional industries with digital technologies, and reshape the original ways in which factors are matched. Relying on the ultra-large-scale domestic-demand

market, create abundant application scenarios; use scenarios to drive technological iteration and form a positive cycle of "market scenarios—technological breakthroughs—industrial strengthening." Rely on continuous innovation to renew the forms of factor combinations, ensure that combinatorial advantages possess the capacity for dynamic evolution, and avoid becoming locked into a new round of paths.

(V) Institutional Empowerment: Building a Governance System Adapted to Systemic Competition

Effective combination of factors cannot be separated from the support of the institutional environment. At the comparative-advantage stage, the policy focus tends to be on reducing the costs of individual factors; land concessions, tax reductions and exemptions, and investment-attraction subsidies are commonly used instruments. To cultivate combinatorial advantage, policy objectives must shift from lowering factor costs to improving the efficiency of systemic coordination.

The logic of government governance needs to transform: from selectively favoring particular industries and particular enterprises to building a universally beneficial and collaborative industrial ecosystem. This requires improving the intellectual-property protection system and stimulating the willingness of multiple actors to engage in collaborative innovation; establishing a multi-level investment and financing system suited to the long-term capital needs of innovative industries; improving cross-regional collaborative governance mechanisms, coordinating the industrial layout of urban agglomerations, and regulating disorderly competition; and establishing an industrial-chain risk early-warning system to strengthen industries' risk-resistance capacity. The core functions of government lie in eliminating barriers to coordination, building public platforms, improving market rules, and fully relying on market mechanisms to allocate combinations of factors, so as to achieve concerted efforts by government and market and continuously nourish industrial combinatorial advantage.

VII. Conclusions and Prospects

The theory of comparative advantage has supported the evolution of the global division of labor in industrial civilization for several centuries, and it has also supported China through the initial stage of industrialization and a phase of rapid growth, possessing indelible theoretical value and practical significance for particular stages. Yet we must maintain a high degree of theoretical self-awareness: the static theory of division of labor applicable to the early stage of industrialization cannot be infinitely expanded or absolutized. Comparative advantage is built on a series of stringent assumptions that are increasingly detached from reality; it has inherent defects such as static-equilibrium thinking, neglect of increasing returns to scale, avoidance of unequal distribution in value chains, and endogenous endowment determinism. These determine that it cannot respond to the contemporary issues of high-quality development in a major

country, industrial-chain security, and the cultivation of new quality productive forces. In the face of the reshaping of the global landscape and the impact of a new round of technological revolution, the paradigm of comparative advantage—under static, single-point, and endowment-bound conditions—can no longer bear the contemporary mission of building a modernized industrial system. Profound changes in the rules of industrial competition and the transformation of competitive forms from rivalry among individual factors to confrontation among industrial systems make theoretical paradigm iteration historically inevitable.

The paradigm of combinatorial advantage inherits the rational core of comparative advantage, introduces systems-coordination thinking, focuses on factor coupling, ecological symbiosis, and dynamic construction, and effectively explains new economic phenomena such as industrial integration, cluster innovation, and industrial-chain security. The evolutionary trajectories of the two paradigms are clear: comparative advantage solves the problem of industries "emerging from nothing," while combinatorial advantage supports industries in moving "from large to strong." The move from comparative advantage toward combinatorial advantage implies three deep transformations: from reliance on innate endowments to the active creation of dynamic capabilities; from fragmented specialized competition to industrial-ecosystem collaboration; and from passive embedding in global value chains to the active shaping of new patterns of industrial cooperation. The Yangtze River Delta new-energy vehicle industrial cluster' s

Practice has fully demonstrated that once dispersed regional comparative advantages break through administrative boundaries and achieve systemic reshaping, they can generate industrial competitiveness that no single region can attain, while also confirming the limitations of relying solely on comparative advantages to develop regional division of labor. This fully demonstrates the strong theoretical explanatory power and practical guiding value of combinatorial advantage.

Looking to the future, cultivating industrial combinatorial advantage is an important theoretical lever for developing new quality productive forces and advancing the construction of a Chinese-style modern industrial system. In practice, it is necessary to ground efforts in local industrial foundations, activate all kinds of comparative-advantage resources, break down barriers to factor mobility, build collaborative carriers on the basis of industrial-chain clusters, rely on innovation to continuously optimize the configuration of factor combinations, and supplement these efforts with systematic institutional reform, so as to continuously forge an industrial-system competitiveness that is difficult to replicate and capable of self-evolution. In the long run, a country' s—or a region' s—position in the new round of global industrial competition depends on its capacity to integrate diverse factors and continuously iterate high-quality industrial combination models. The task of the era for industrial development has already been renewed: it is no longer confined to activating one' s own inherent advantages, but lies in learning to integrate all available resources and proactively create combinatorial advantages of one' s own.

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Industrial Development: From Comparative Advantage to Combination Advantage

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Abstract: The theory of comparative advantage provides important guidance for the industrialization of latecomer economies, supporting China in building a complete industrial system based on factor endowments. However, in the context of geopolitical adjustments and the decline of factor dividends, the static endowment paradigm is prone to problems such as path locking and low-end value-chain capture. Current industrial competition is shifting toward systemic confrontation within industrial ecosystems. This article proposes the theory of combinatorial advantage, breaking through the linear superposition thinking of factors and relying on the coupling and symbiosis of heterogeneous factors to stimulate the emergence effect of the system. The article reflects on the boundaries of comparative advantage theory, constructs a framework for analyzing combined advantages, and conducts empirical tests on the Yangtze River Delta new energy vehicle cluster to clarify the iterative logic of the two paradigms. Research has shown that comparative advantages adapt to industries from scratch, while combined advantages support industries from large to strong. The key to industrial upgrading in the new stage lies in actively cultivating dynamic and sustainable industrial combination advantages.

Keywords: comparative advantage; Combination advantage; Industrial paradigm; New Quality Productivity