Research on Policy Coordination of Industrial Green Transformation under the "Dual Carbon" Target: Interaction between Fiscal, Financial and Industrial Policies

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Abstract: This study systematically examines the interaction mechanisms among fiscal, financial, and industrial policies in addressing industrial green transformation under the "dual carbon" goals. By constructing a "goal-instrument-effect" theoretical framework, it reveals the complementary yet potentially conflicting roles of these three policy categories in resource allocation, risk sharing, and market incentives. The research proposes cross-departmental institutional optimization pathways for effective policy coordination. Effective policy synergy requires dynamic boundary conditions: leveraging fiscal levers to mobilize financial capital, guiding technological pathways through industrial policies, and establishing feedback regulation systems via carbon markets and digital governance. China needs to develop flexible policy instruments and long-term coordination mechanisms to balance government intervention with market autonomy, thereby creating a transformational governance model that achieves both efficiency and equity.

Keywords: Dual Carbon Target; Policy Coordination; Green Transformation; Financial Interaction; System Innovation

1. Introduction

Under the strategic framework of China's "dual carbon" goals, industrial green transformation has emerged as a crucial pathway to achieve coordinated progress in sustainable economic development and climate governance. However, individual policy instruments often prove inadequate in addressing the multidimensional challenges during this transition, necessitating systematic coordination among fiscal, financial, and industrial policies. This study focuses on the interactive mechanisms among three types of policies, constructs a theoretical framework, and reveals how policy synergy drives green transformation. The findings provide academic support for optimizing policy design, offering practical insights for advancing sustainable development.

2. The Logical Basis of Theoretical Framework and Policy Coordination

2.1 The Connotation of "Dual Carbon" Goals and Green Transformation

As China's core strategy to address global climate change, the "dual carbon" goals impose binding constraints through dual controls on total carbon emissions and emission intensity, requiring profound restructuring of economic growth models and energy structures. These targets not only establish clear timelines but also compel industrial systems to transition toward low-carbon and green development through policy rigidity. The essence of industrial green transformation lies in reducing environmental impact per unit output through technological innovation, optimized production methods, and resource recycling-inherently coupled with the dual carbon goals: the former serves as the implementation pathway for the latter, while the latter provides policy impetus for the former. However, the transition faces three major barriers: technological, financial, and institutional. Technologically, R&D and application of low-carbon technologies exhibit long cycles and high risks, compounded by traditional industries' reliance on mature technical pathways that creates "lock-in effects." Financially, green projects require substantial initial investments with extended payback periods, leading to insufficient private capital participation and significant market failures. Institutionally, existing policy frameworks often show fragmentation with unclear departmental responsibilities and inconsistent standards, hindering coordinated governance effectiveness.

These intertwined barriers make it difficult for single policy tools to break through transformation bottlenecks, urgently requiring systematic coordination among fiscal, financial, and industrial policies to reduce transition costs, optimize resource allocation, and strengthen institutional safeguards[1].

2.2 Functional Positioning of Fiscal, Financial and Industrial Policies

Fiscal policy, financial policy, and industrial policy serve as core tools driving green industrial transformation, each demonstrating distinct characteristics in resource allocation, risk distribution, and market incentives. Fiscal policy directly regulates economic activities through tax adjustments, public spending, and subsidy mechanisms, primarily addressing market failures-such as internalizing environmental costs via carbon taxes or reducing corporate innovation risks through green technology R&D subsidies. Financial policy focuses on optimizing capital flows to low-carbon sectors through monetary supply, targeted credit allocation, and capital market guidance. Tools like green credit and carbon neutrality bonds lower financing costs for eco-friendly projects, while carbon financial markets incentivize emission reductions through price signals. Industrial policy exhibits structural characteristics, shaping industrial ecosystems through technical standards, sectoral planning, and access restrictions. For instance, new energy industry support policies accelerate technological iteration and capacity expansion. These three policy types complement each other functionally: fiscal policy provides initial momentum for green transition, financial policy ensures sustained capital supply, and industrial policy optimizes long-term development pathways. However, potential conflicts exist: excessive fiscal subsidies may distort market pricing, profit-driven financial policies could foster "greenwashing" practices, and rigid industrial interventions might stifle spontaneous market innovation. Therefore, the key to policy synergy lies in balancing functional boundaries and establishing a dynamically adaptive interaction framework that harmonizes resource allocation efficiency, rational risk sharing, and market incentives[2].

2.3 Theoretical Model Construction of Policy Coordination

Under the "dual carbon" goals, the collaborative mechanisms of fiscal, financial, and industrial policies need to transcend traditional single-policy analytical paradigms and instead establish a systematic theoretical framework to reveal their interactive logic. From a systems theory perspective, policy coordination is essentially a dynamic composite system where subsystems like fiscal, financial, and industrial policies form holistic effects through factor exchange and functional coupling. This system exhibits nonlinear characteristics: policy tool combinations are not merely additive but may generate synergistic or offsetting effects. Game theory further reveals strategic interactions among government departments, market entities, and financial institutions during policy implementation, including issues like interest competition, information asymmetry, and incentive compatibility. The proposed three-dimensional coordination analysis framework of "goal-instrument-effect" deconstructs policy coordination into three levels: At the goal level, emission reduction targets under "dual carbon" constraints and industrial competitiveness goals require dynamic balancing; at the instrument level, combinations of fiscal subsidies, green credit, and technical standards must consider temporal alignment and intensity adaptation; at the effect level, long-term impacts on technological innovation, capital allocation, and market structure need evaluation. This framework particularly emphasizes defining dynamic boundary conditions: On one hand, policy coordination effectiveness is constrained by macro-level factors like economic development stages and industrial structure characteristics; on the other hand, micro variables such as carbon market maturity and green technology breakthroughs can reshape the effective boundaries of policy tools. Through this theoretical model, the key nodes in policy coordination can be systematically identified, such as how to connect the exit timing of fiscal policy with the risk pricing mechanism of financial markets, or how to guide the priority investment of public R&D funds by industrial technology roadmap[3].

3. Mechanism Analysis and Path Design of Policy Interaction

3.1 The Leverage Effect of Fiscal Policy and the Risk Hedging of Financial Policy

Under the guidance of the "dual carbon" goals, the coordinated interaction between fiscal and financial policies forms the core mechanism driving industrial green transformation. Fiscal policy leverages its unique multiplier effect to effectively channel financial capital into low-carbon sectors, primarily through three dimensions: First, positive incentive tools like green subsidies significantly enhance investment appeal for low-carbon projects by reducing corporate technological transformation costs and operational risks. Second, binding policies such as carbon taxes increase economic costs for high-emission activities, compelling market entities to adjust investment decisions and creating a "crowding-out effect" for green industries. Finally, demonstration policies like government green procurement shape market demand expectations, providing stable returns for financial institutions. This fiscal guidance mechanism requires deep integration with financial policies 'risk hedging functions: On one hand, policy banks can share commercial banks' credit risks through preferential loans and credit enhancement guarantees; on the other hand, the development of carbon finance markets provides market-based tools for environmental risk pricing, enabling financial institutions to transfer risks via derivatives trading. Crucially, the synergy between fiscal and financial policies demands dynamic adjustment mechanisms, including coordination between subsidy phase-outs and market-based financing, as well as linkage between carbon tax revenues and green funds, to prevent policy arbitrage and market distortions. The optimization direction for this synergy lies in establishing a multi-tiered risk compensation system-both lowering financing thresholds through fiscal interest subsidies and developing specialized green insurance products-to ultimately form a sustainable financing ecosystem guided by government leadership and driven by market forces. In this process, policy makers need to pay special attention to the selection intensity and role cycle of financial tools, so as to ensure that they can effectively leverage financial capital without creating long-term market dependence, and truly realize a smooth transition from policy-driven to market-driven[4].

3.2 The Guiding Role of Industrial Policy and the Adaptability of Financial Support

Industrial policies play a pivotal role in shaping technological pathways during green transition. By establishing industry standards, capacity planning, and market access restrictions, they directly determine the low-carbon evolution of industrial systems. This guiding mechanism exhibits dual characteristics: On one hand, clear industrial planning accelerates the large-scale adoption of specific green technologies, such as rapidly forming related industrial chains through renewable energy targets like solar and wind power installations. On the other hand, premature or excessive locking of technological routes may lead to homogenization of innovation ecosystems and suppress R&D investments in alternative technologies, particularly evident in emerging fields like hydrogen energy and carbon capture. To mitigate these risks, industrial policies require moderate flexibility and dynamic evaluation mechanisms that ensure technological choices meet current emission reduction needs while reserving space for future breakthroughs. Financial support plays a crucial role here, with the core being the establishment of financing systems aligned with industrial transformation stages. During the technology incubation phase, policy-backed financial institutions and venture capital should provide long-term patient capital through tools like R&D loans and technology bonds to support basic research. In early industrialization stages, green credit and project financing instruments should be developed to expand production capacity. At maturity promotion stages, market-oriented approaches such as asset securitization and supply chain finance should be adopted to enhance capital turnover efficiency. Financial innovations must keep pace with policy adjustments-when industrial planning shifts from single-technology support to diversified technologies, financial products should transition from concentrated credit allocation to portfolio investment strategies. The establishment of this dynamic adaptation relationship requires not only the government departments to embed financial considerations into industrial policies, but also the financial institutions to deeply participate in the formulation of industrial planning. Through information sharing and collaborative decision-making, a precise docking mechanism between industrial demand and financial supply can be formed, so as to provide continuous and stable financial guarantee for the whole life cycle of green technology[5].

3.3 Institutional Barriers and Breakthrough Paths of Cross-Departmental Collaboration

In the green industrial transformation under China's "dual carbon" goals, the coordinated implementation of fiscal, financial, and industrial policies faces deep-seated institutional barriers. These obstacles primarily stem from the inherent contradictions between the administrative management system's rigid characteristics and the complex demands of governance transformation. From an organizational structure perspective, policy domains fragmented by professional divisions create ambiguous authority boundaries. For instance, finance departments focus on subsidy effectiveness, financial institutions prioritize risk control, while industrial sectors pursue technological breakthroughs. Such divergent objectives often lead to competitive allocation of policy resources. The current performance evaluation system reinforces departmental insularity, driving agencies to favor quantifiable unilateral policy tools that highlight achievements rather than long-term collaborative solutions. At the stakeholder level, differing perceptions of transition timelines trigger substantive power struggles: industrial authorities seek protective policies to sustain existing enterprises, fiscal departments worry about the sustainability of excessive subsidies, while financial institutions face short-term profit pressures that hinder green finance implementation. Breaking through these institutional barriers requires three-dimensional optimization strategies: First, establishing a cross-departmental information sharing platform to eliminate information silos through unified data standards and disclosure mechanisms, with a focus on integrating core data streams such as carbon emission monitoring, corporate environmental credit, and green project financing. Second, innovating performance linkage mechanisms by incorporating interdepartmental policy coordination effectiveness into evaluation metrics, designing an assessment framework that includes composite indicators like emission reductions, green investment ratios, and technology conversion rates. Finally, improving dispute resolution systems by establishing a policy evaluation and adjustment committee composed of multi-disciplinary experts under the State Council's Carbon Peaking and Carbon Neutrality Leading Group to conduct third-party reviews of major collaborative initiatives. These institutional innovations fundamentally reshape the organizational logic of policy processes, transforming fragmented administrative systems into networked governance structures. Their successful implementation requires both mandatory institutional reforms at the top level and adaptive learning across departments at the operational level, ultimately forming a climate governance collaboration model with Chinese characteristics[6].

4. Evaluation and Optimization Direction of Policy Coordination Effectiveness

4.1 Evaluation Dimensions and Methodology of Collaborative Efficacy

Under the "dual carbon" goals, scientific evaluation of policy synergy effectiveness requires breaking through traditional single-dimensional analytical paradigms and establishing a comprehensive assessment framework encompassing economic efficiency, environmental benefits, and social equity. The design of this multidimensional indicator system must first address challenges in weight allocation and quantification across different policy objectives: The economic efficiency dimension should measure the policy mix's impact on total factor productivity, including core indicators such as input-output ratios of green technology innovation and contribution rates of low-carbon industries to added value; The environmental benefit dimension should focus on absolute and intensity changes in carbon reduction while considering coordinated pollution control effects, establishing a quantitative system incorporating parameters like carbon footprint, energy intensity, and ecological restoration areas; The social equity dimension, though crucial, is often overlooked-it requires assessing distributive justice in transition costs across regions, industries, and groups, with indicators like employment structure transformation index and SMEs' access to green financing reflecting the degree of equitable transition. Methodologically, this evaluation system faces three key challenges: First, determining threshold standards for each dimension must balance the rigid constraints of "dual carbon" targets with varying socioeconomic capacities at different development stages; Second, resolving temporal contradictions between long-term environmental benefits and short-term economic pressures necessitates innovative approaches like dynamic discount rates; Third, addressing data availability and standardization gaps, particularly in overlapping fields of green finance and industrial policies where existing statistical systems show significant shortcomings. To address these challenges, this study proposes a "hierarchical-coupling" evaluation framework: The foundational layer employs econometric models to quantify causal relationships between policy instruments and three types of benefits; the intermediate layer utilizes system dynamics to simulate the cumulative effects of policy combinations; while the decision-making layer optimizes weights for different value orientations through multi-criteria decision analysis. This innovative methodology effectively identifies optimal combinations of fiscal subsidies, green credit quotas, and production capacity standards, providing scientific evidence for subsequent policy calibration[7].

4.2 International Experience Comparison and Localization Enlightenment

At the international level, the practice of policy coordination under the "dual carbon" goals exhibits distinct institutional path dependence. Major developed countries have established three typical paradigms: The EU's "regulation-led model" creates the world's most stringent carbon market system and cross-border carbon tariff mechanisms, deeply integrating fiscal carbon taxes with financial derivatives; The US "market-driven model" leverages fiscal incentives alongside green bond tax breaks and SEC climate disclosure rules to foster a public-private investment ecosystem; Japan's "technology-driven approach" implements a government-industry-academia collaborative "green innovation strategy," precisely aligning fiscal R&D subsidies, policy-based finance, and industrial technology roadmaps. These paradigm differences profoundly reflect institutional endowments in political systems, market structures, and industrial foundations: The EU's strong regulatory framework stems from its multinational negotiation needs, the US market-oriented orientation corresponds to its financial hegemony, while Japan's technology-focused approach continues its tradition of catch-up modernization. For China, the localization of these experiences requires focusing on three key dimensions: First, in policy coordination, it should avoid the risk of industrial relocation caused by the EU's over-reliance on administrative regulations. While learning from its carbon market and financial instrument integration mechanisms, China needs to establish a differentiated carbon pricing system tailored to regional development imbalances. Second, in implementation approaches, it can adopt the U.S. model of leveraging tax incentives to mobilize private capital, but must strengthen regulatory warnings against "green bubbles," particularly in sectors with new energy overcapacity. Third, regarding technological pathways, Japan's experience teaches balancing breakthroughs in cutting-edge technologies with modernizing traditional industries, avoiding the trap of "innovation for innovation's sake." Notably, China's institutional strengths lie in robust policy execution and economies of scale, providing unique advantages for building a coordinated mechanism of "top-level design-local pilots-nationwide promotion." Future improvements should focus on: establishing a coordination committee between carbon reduction policies and macroeconomic policies to break down departmental silos; developing transition finance instruments suitable for heavy industry structures to fill gaps in existing green finance standards; and creating an industry chain-based carbon footprint accounting system to support data-driven precision policy implementation[8].

4.3 Dynamic Adjustment and Long-Term Coordination Mechanism Construction

In advancing the "dual carbon" goals, policy coordination mechanisms must demonstrate dynamic adaptability to address uncertainties such as technological breakthroughs, market fluctuations, and institutional evolution. The flexibility of policy instruments is reflected in three dimensions: Temporal flexibility requires phased exit mechanisms for fiscal subsidies and green credit to prevent market turbulence caused by abrupt policy discontinuities; Intensity flexibility is demonstrated through dynamic range management of carbon pricing tools, balancing emission reduction costs with corporate affordability via price corridors; Structural flexibility necessitates maintaining diversified industrial pathways while reserving policy space for emerging low-carbon technologies. The core of establishing a long-term coordination mechanism lies in creating a dual-driven feedback system integrating "carbon markets and digital governance": Carbon markets provide real-time price signals reflecting emission reduction costs and outcomes, offering quantitative basis for policy adjustments; Digital governance platforms consolidate multi-dimensional data including emission monitoring, capital flows, and industrial operations, using big data analytics to identify policy lags or cumulative effects. This system's innovation transforms the traditional linear "formulate-implementation" process into a closed-loop "monitor-evaluate-optimize" governance model. Its effective operation relies on four pillars: a standardized carbon accounting system ensuring data comparability; intelligent policy impact assessment models enabling multi-scenario simulations; cross-departmental digital sharing mechanisms breaking information barriers; and institutionalized policy review procedures guaranteeing timely adjustments. This mechanism must properly balance government leadership with market autonomy.-During the initial transition phase, substantial policy interventions are required to cultivate a market system. As carbon markets mature and enterprises enhance their low-carbon capabilities, the approach should gradually shift toward a collaborative model dominated by market mechanisms. Achieving this dynamic equilibrium requires establishing a multi-stakeholder governance network involving academia, industry, and public participation, while creating a learning mechanism for policy iteration and updates. Ultimately, this will form a resilient climate governance system that provides a Chinese-characterized institutional innovation model for global carbon neutrality efforts.

5. Conclusions

By analyzing the synergistic logic between fiscal, financial, and industrial policies under the "dual carbon" goals, this study demonstrates the irreplaceability of multidimensional policy interactions in overcoming green transition bottlenecks. The research reveals that effective coordination requires three fundamental prerequisites: alignment of objectives, compatibility of tools, and institutional coordination as safeguards. Future studies could further quantify synergistic effects and explore region-specific policy combinations tailored to local conditions.

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