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THE HAND OF THE MARKET, THE WAY OF GOVERNANCE: PARADIGM INNOVATION OF PUBLIC GOVERNANCE IN CHINA'S GREEN FUTURES PRACTICE

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Abstract
Using the innovative practice of China's green futures market as a "small incision," this paper explores the "big question" of how financial markets can be used as tools for public governance from both theoretical and practical perspectives. Against the backdrop of the global sustainable development transition, traditional "command-and-control" environmental regulation tools face efficiency bottlenecks and weak incentives. This paper argues that futures contracts are evolving from purely economic tools into "governance contracts" that carry public policy objectives. Through three core mechanisms—price discovery, risk management, and standard embedding—futures markets can internalize environmental externalities and provide dynamic, forward-looking incentive signals for sustainable development. The article conducts an in-depth analysis of concrete practices in fields such as new energy metals, green agricultural products, and the circular economy at the Guangzhou Futures Exchange, Zhengzhou Commodity Exchange, and Shanghai Futures Exchange, revealing their multi-dimensional governance value in serving China's "dual-carbon" goals, safeguarding industrial chain security, and promoting common prosperity. The study finds that this practice vividly embodies China's theory of combining an "effective market" with a "proactive government," forming a new paradigm of collaborative governance among top-level national design, market intermediary institutions, and micro-level market entities. Finally, the paper discusses the governance challenges facing this model—including data infrastructure, regulatory coordination, and participation equity—and proposes corresponding optimization pathways. The goal is to provide theoretical references and policy insights for improving the sustainable financial governance system with Chinese characteristics and for building an autonomous knowledge system in public administration.

Keywords: green futures; sustainable development; public governance; market-based environmental regulation; effective market; proactive government

1.INTRODUCTION:

The New Frontier of Public Governance and the "Small Incision" Problem

1.1 Global Sustainable Development Transition and Governance Dilemmas

Since the beginning of the 21st century, problems such as intensified climate change, tightening resource constraints, and social injustice have become increasingly prominent. Sustainable development has risen from a marginal environmental issue to a core agenda of global governance and a shared value goal of human society. The objective of sustainable development is "to meet the needs of the present without compromising the ability of future generations to meet their own needs." Its connotation covers the three interrelated dimensions of environment, society, and economy—the so-called "triple bottom line" (Elkington 1997). This profound transformation not only requires a reshaping of the global economic structure, but also fundamentally challenges traditional public administration theory and practice.

For a long time, governments have primarily relied on "command-and-control" regulatory instruments to address externalities such as environmental problems (Gunningham and Sinclair 2017). Such regulation directly intervenes in the production and operation behavior of market entities by setting uniform emission standards, technical specifications, or market access thresholds. While this approach has clear, direct advantages when dealing with extreme and urgent environmental problems, its limitations have become increasingly obvious. Its rigid "one-size-fits-all" characteristic not only leads to high regulatory costs, but also fails to take into account the heterogeneity of different market entities, thereby failing to effectively incentivize enterprises to undertake green technology innovation beyond

mere compliance. Moreover, rent-seeking and strategic behavior during the enforcement process may even undermine market fairness (Yu and Chen 2010).

Traditional public administration theories—whether rooted in the classical Weberian bureaucratic model or in the subsequent New Public Management (NPM) movement—appear inadequate when confronting "wicked problems" such as climate change, which are characterized by deep uncertainty, value conflicts, and complex cross-domain dependencies (Rittel and Webber 1973). These theoretical models often presuppose a clear boundary between the state as regulator and the market as the regulated. However, sustainable development precisely calls for a new governance paradigm that blurs these traditional boundaries and is more collaborative, adaptive, and networked. As the global sustainable development agenda becomes increasingly complex and dynamic, a shared challenge for governments worldwide is how to innovate public governance tools so as to guide massive social resources toward green, low-carbon, and inclusive areas with lower social costs, higher allocation efficiency, and stronger incentive compatibility. At its core, this challenge ultimately returns to the fundamental proposition of public administration: how to define and optimize the relationship between government and the market (Lin 2012).

1.2 Research Entry Point: The Evolution from Financial Instrument to Governance Mechanism

In response to the above grand governance proposition, this paper selects the burgeoning practice of China's green futures market as a "small incision" to examine this "big question." This methodological choice is deliberate, aiming to anchor a high-level theoretical debate about state–market relations in concrete empirical evidence. As a core component of the modern financial system, the traditional functions of the futures market are defined as price discovery and risk management (Hull 2019). However, as China elevates sustainable development to the level of national strategy, the role of the futures market is undergoing profound evolution. From agricultural futures serving the "Agricultural Power" strategy, to industrial product futures supporting the "Manufacturing Power" strategy, and now to new energy metal futures facilitating the "Green Transformation," a series of futures product innovations closely aligned with national strategies reveal the immense potential of futures markets as a new type of public governance tool (China Futures Association 2024).

The core argument of this paper is that the practice of China's green futures is not merely a business innovation in the financial domain, but a profound shift in governance paradigm. It is not a simple case of direct government intervention in the market, but rather a more sophisticated institutional design that internalizes the state's macro-strategic goals (such as the "dual-carbon" targets, industrial chain security, and common prosperity) into the micro-level incentive signals and business decision-making logic of market participants. In this process, the nature of futures contracts undergoes a fundamental transformation: when environmental standards are incorporated into the design of deliverable grades, and when the forward price curve reflects expectations about future green policies, futures contracts transcend purely commercial agreements and evolve into a new type of institutional arrangement that carries public policy objectives and performs public governance tasks through market transactions—a form of "governance contract."

This practice vividly interprets the governance philosophy of combining an "effective market" with a "proactive government" in the socialist market economy with Chinese characteristics , going beyond the traditional state–market dichotomy prevalent in much Western theory (Fligstein 2001). It demonstrates a unique path in which the state does not intervene from outside of the market, but rather constructs and guides from within. The government sets the strategic direction, promotes semi-public institutions such as exchanges to design financial products that embody the strategy, and ultimately relies on the market's own logic to achieve public goals. This provides an excellent analytical sample for understanding the modernization of state governance with Chinese characteristics and contributes to building an autonomous knowledge system in public administration.

1.3 Research Framework and Structure

The structure of this paper is arranged as follows. Section 2 constructs an analytical framework that integrates market-based environmental regulation theory with the theory of China's state–market relations, arguing for the theoretical logic behind the evolution of futures markets from economic tools to governance mechanisms. Section 3 systematically analyzes the governance innovation practices of China's green futures market, using the Guangzhou Futures Exchange as a representative case to provide an in-depth "small-incision" description. Section 4 delves into the internal mechanisms, examining the transmission pathways and paradigm characteristics of collaborative governance from economic, environmental, and social dimensions. Section 5 objectively assesses the challenges currently faced by this governance model and proposes corresponding optimization paths. Finally, Section 6 summarizes the findings and extracts the implications of China's practice for public administration theory and global sustainable governance.

2. THEORETICAL FRAMEWORK: THE FUTURES MECHANISM AS A MARKET-BASED GOVERNANCE TOOL

2.1 The Evolution of Environmental Regulation Theory: From the "Commanding Hand" to the "Market Hand"

The evolution of environmental regulation theory is, in essence, a process of continuous adjustment and deepening of the government–market relationship in the field of environmental governance. Early "command-and-control" regulation reflected the strong role of the government as the primary regulator, with its theoretical basis in correcting "market failure" caused by environmental externalities (Bator 1958). However, practice has shown that governments can also face the dilemma of "government failure," such as information asymmetry, regulatory capture, and administrative inefficiency (Wolf 1979). The limitation of this "commanding hand" lies in its attempt to use uniform administrative directives to address heterogeneous market entities. This not only leads to high total social abatement costs, but also suppresses enterprises' motivation for technological innovation due to a lack of flexibility.

To overcome these drawbacks, market-based environmental regulation theory emerged, with its intellectual origins traceable to A.C. Pigou and R.H. Coase (Pigou 1920; Coase 1960). Its core idea is to "internalize" environmental externalities into enterprises' production costs by creating and utilizing price signals, thereby incentivizing firms to autonomously seek the lowest-cost pollution control path (Stavins 2003). Whether through levying environmental taxes (Pigouvian taxes) or establishing emissions trading systems (an application of the Coase theorem), these market-based "incentive hands" are generally considered more cost-effective and more conducive to technological innovation than the "commanding hand" (Stavins 2003). They acknowledge and leverage heterogeneity across enterprises, allowing those with lower abatement costs to reduce more emissions and benefit from market transactions, thus achieving environmental objectives at the lowest total social cost.

2.2 The Futures Market: A More Advanced Market-Based Governance Mechanism

If instruments such as environmental taxes and spot carbon markets provide "static" or "near-term" pricing of environmental costs, then futures markets offer a more advanced, dynamic, and forward-looking market-based governance mechanism. Their uniqueness lies not only in addressing the "spatial dimension" of resource allocation efficiency, but also in deeply engaging with the most intractable "time dimension" problem in environmental governance. The consequences of environmental problems such as climate change are long-term and lagged, whereas the behavior of market entities (seeking short-term profits) and government officials (subject to term limits) tends to be short-term. This mismatch between "short-term behavior" and "long-term goals" is at the heart of the sustainable governance dilemma (Giddens 2009).

Futures markets effectively correct this "myopia" through their unique intertemporal pricing mechanism. Their core governance functions can be understood on three interrelated levels:

Forward-Looking Price Guidance. Futures markets form a forward price curve covering months or even years into the future through centralized, continuous auction trading (Fama 1970). This curve not only reflects current supply-and-demand fundamentals, but more importantly aggregates the collective expectations and judgments of all market participants regarding future technological progress, policy changes, resource scarcity, and macroeconomic trends. For green industries, this forward-looking price signal acts as a "lighthouse," providing valuable decision-making guidance for green projects with long investment cycles and high uncertainty, thereby directing social capital accurately toward directions consistent with long-term sustainable development goals. This effectively compensates for the failure of traditional financial markets to support green innovation (Mazzucato 2013).

Systematic Risk Management. The sustainable development transition is inherently fraught with risks and uncertainties, including technological disruptions, industrial policy adjustments, and sharp volatility in commodity prices. These risks are key obstacles preventing enterprises from making long-term green investments. By providing standardized hedging tools such as futures and options, futures markets enable enterprises to lock in future costs or revenues, stabilize business expectations, and thereby greatly enhance the resilience of the entire green industrial chain (Bartram et al. 2011). A market environment that can effectively manage risks is a necessary institutional precondition for encouraging enterprises to shift from "passive compliance" to "active transformation."

Embedded Standard-Setting. This is the subtle feature that distinguishes futures markets from other market-based tools. By embedding sustainability requirements such as green, low-carbon, and energy–saving criteria into the deliverable grade standards of futures contracts, exchanges effectively create a market-based "certification" and "incentive" mechanism. Products that meet higher green standards gain competitive advantages in the market because they qualify for delivery or receive price premia. This "green premium" mechanism generates a self-purifying effect in which "good money drives out bad," internalizing external regulatory requirements into the intrinsic motivation of enterprises to enhance their market competitiveness. It is a form of "soft regulation" or "embedded supervision" that is more cost-effective and efficient than administrative inspections.

2.3 Theoretical Integration in the Chinese Context: "Effective Market" and "Proactive Government"

Placing the above theories in China's unique governance context reveals a profound theoretical integration. The core of China's public administration theory and practice has always revolved around

managing the relationship between government and market (Zhou 2007). Since the 18th National Congress of the Communist Party of China, it has been explicitly stated that "the market should play the decisive role in resource allocation and the government should play its role better" (CPC Central Committee 2013). This is not a simple zero-sum relationship, but one of dialectical unity and synergistic interaction.

The combination of an "effective market" and a "proactive government" is fully reflected in the governance practice of green futures.

The "effective market" is manifested in the fact that once the institutional framework is established, key functions such as price discovery, risk management, and resource allocation are mainly realized through the autonomous operation of the market mechanism. Enterprises' hedging decisions, capital flows, and market premia for green standards are all spontaneously formed by the profit-maximizing behavior of countless decentralized market entities, thereby ensuring the efficiency and vitality of the governance process.

The "proactive government" acts as the architect of market order and the guide of public objectives. Its role is not to directly intervene in prices or dictate resource allocation, but to act at three key levels. First, as an institutional supplier, it creates and maintains a fair, transparent, and efficient futures market rule system through laws, regulations, and administrative approvals (La Porta et al. 1998). Second, as a strategic navigator, it clarifies the state's macro goals for sustainable development (such as the "dual-carbon" targets) through industrial policies and guidance, and directs financial markets to serve these goals; for example, by supporting the Guangzhou Futures Exchange in building a green futures trading platform (GFEX 2023). Third, as a risk watchman, it establishes cross-departmental, cross-market regulatory coordination mechanisms to monitor and prevent potential systemic financial risks, ensuring that market innovations do not deviate from the path of stable operation (PBoC 2024).

2.4 Futures Exchanges as Quasi-Public Governance Entities

Within the synergistic framework of an "effective market" and a "proactive government," futures exchanges play a unique and critical role. They are neither purely government agencies nor ordinary commercial enterprises, but quasi-public governance entities situated between the two—a type of "hybrid organization." In China, major futures exchanges are established with the approval of the State Council and are subject to vertical and unified supervision by the China Securities Regulatory Commission (CSRC), which endows them with strong public attributes.

The governance function of these exchanges is concentrated in their role as market "rule-makers" and "institutional engineers." The concept of the "governance contract" is only made possible by this unique institutional arrangement. The design and listing of a new futures product is essentially a highly complex institutional innovation project. Every step—from determining the underlying asset and designing contract terms, to setting delivery standards and building a risk control system—contains profound governance considerations. For example, when designing the lithium carbonate futures contract, the Guangzhou Futures Exchange (GFEX) had to consider not only its financial attributes, but also its role in serving the strategic security of the national new energy vehicle industry. The setting of its deliverable grades directly affects the production standards and technological trajectories of enterprises along the industrial chain (GFEX 2024). For this reason, the behavior of the exchange transcends pure commercial logic and becomes a key "transducer" transmitting the state's macro-strategic intentions to micro-level market behavior. This perspective elevates exchanges from passive trading platforms to active governance hubs connecting the state and the market, and is key to understanding China's financial governance system with its distinctive characteristics. It reveals the central mechanism of the Chinese model: the state does not merely regulate the market from the outside; it shapes the very architecture of the market from within through these quasi-public intermediaries.

In summary, the governance practice of China's green futures can be understood as a creative combination of market-based environmental regulation theory and the theory of state–market relations with Chinese characteristics. It transcends the simple dichotomy of "government failure" versus "market failure," and explores a new path of modern governance characterized by "empowerment through top-level national design, autonomous operation of the market mechanism, and collaborative governance by multiple entities."

3. "Small-Incision" In-Depth Description: The Governance Innovation Practice of China's Green Futures

The vitality of theory lies in practice. This section delves into concrete practices in China's green futures market, showing through case studies of different exchanges how the aforementioned theoretical framework operates and what governance outcomes it produces. The selected cases are not merely a collection of examples, but represent a sophisticated and differentiated portfolio of governance instruments, strategically deployed to achieve industrial, environmental, and social policy objectives simultaneously.

3.1 Top-Level Design: The Resonance Between National Strategy and Financial Policy

The development of China's green futures market is not a spontaneous product of the market, but a

strategic layout advanced step by step under the clear guidance of top-level national design. Since the "dual-carbon" goals (peaking carbon emissions before 2030 and achieving carbon neutrality before 2060) were established, how the financial system can serve this profound socio-economic transformation has become a core question in public policy making.

The policy context clearly demonstrates this strategic transmission process. In early 2025, the China Securities Regulatory Commission issued the Implementation Opinions on the Capital Market's Role in the "Five Major Areas of Finance," explicitly placing "green finance" at the core. The document proposed to "develop more green and low-carbon futures and options products that meet the needs of real economic development," and specifically mentioned support for the Guangzhou Futures Exchange in building a "green futures trading platform" (CSRC 2025). Subsequently, the Guiding Opinions on Financial Support for New Industrialization—jointly issued by the People's Bank of China and six other departments—further emphasized the need to "improve the futures product system driven by industrial needs, and promote the stable supply and prices of bulk commodities." This again highlighted the key role of futures markets in safeguarding the supply chain security of national strategic industries and advancing the green transition (PBoC et al. 2025). These high-level policy documents collectively constitute the "baton" and "roadmap" for the development of the green futures market, ensuring that financial innovation resonates with the national sustainable development strategy.

3.2 Empowering Strategic Emerging Industries: The Guangzhou Futures Exchange as a "Green Testing Ground"

As China's youngest futures exchange, the Guangzhou Futures Exchange (GFEX), established in 2021, was from the outset entrusted with the strategic mission of serving green development and the construction of the Guangdong–Hong Kong–Macao Greater Bay Area, becoming a "testing ground" for China's green futures innovation (Guangdong Provincial Government 2021). The exchange exemplifies how futures tools can be used to support proactive industrial policy in emerging sectors. Its product layout is closely centered on the core raw materials of national strategic emerging industries such as photovoltaics and new energy vehicles, with the aim of addressing two major pain points: sharp price fluctuations and raw material supply security.

The futures and options products launched successively by GFEX—such as industrial silicon, lithium carbonate, and polysilicon—have formed the most comprehensive new energy metal futures system in China. As shown in Table 1, these products quickly exerted governance functions as "stabilizers" of industrial chains and "weathervanes" for investment:

Industrial silicon futures and options serve the photovoltaic and organic silicon industries. The photovoltaic industry is a pillar for achieving the transformation of the energy structure, but the price of its upstream raw material, industrial silicon, fluctuates sharply. Industrial silicon futures provide an effective tool for polysilicon producers to lock in costs. Data show that the hedging coverage ratio of some leading polysilicon enterprises has exceeded 40%, greatly stabilizing expectations for production, operation, and expansion (GFEX 2024).

Lithium carbonate futures and options directly target the core of the new energy vehicle industry—power batteries. As a key raw material for battery cathodes, the price of lithium carbonate surged and plunged within a short period, severely disrupting industrial chain order. After its launch, lithium carbonate futures quickly became the recognized pricing benchmark for the global lithium battery industry chain. Battery manufacturers can effectively manage procurement costs and stabilize end-product prices by using long positions for hedging; upstream lithium salt producers can lock in profits and confidently expand investment by using short hedges; and battery recycling enterprises can use futures price signals to optimize their procurement and sales rhythms, promoting the commercial operation of the resource recycling system. According to statistics, the hedging scale of some leading battery manufacturers has reached 30% of their annual production (SMM 2025).

These practices clearly show that the value of GFEX's new energy metal futures extends far beyond providing financial hedging tools. From a public governance perspective, by offering open, transparent, and authoritative forward price signals, they effectively reduce internal transaction costs and external uncertainties for entire strategic emerging industries, accelerate the industrialization process of key technologies, and provide solid financial infrastructure support for safeguarding national energy security and achieving the "dual-carbon" goals.

Table 1. Analysis of the Governance Functions of GFEX's New Energy Metal Futures.

Product	Served Industry	Core Economic Function	Core Governance Function	Enterprise Application Data
Industrial Silicon	Photovoltaics, Organic Silicon	Lock in raw material costs, stabilize production profits	Ensure photovoltaic industry supply chain stability, support national clean energy strategy	Hedging coverage rate of polysilicon enterprises >40%
Lithium	Power	Stabilize	Maintain new energy	Hedging scale of

Carbonate	Batteries	procurement costs, manage price risk	vehicle industry security, promote industrialization of lithium resource recycling	leading battery makers reaches 30% of annual output
Polysilicon	Photovoltaic Modules	Manage price fluctuation risk, guide long-term contract pricing	Enhance global pricing influence of China's PV industry, accelerate energy structure transformation	PV enterprises use futures prices to guide long-term contract pricing

Source: Compiled by the author, based on data from GFEX (2024) and SMM (2025) as cited in the source document.

3.3 Transforming Traditional Industries and Promoting the Circular Economy: Explorations by ZCE, DCE, and SHFE

In addition to forward-looking layouts in emerging industries, futures markets also play an indispensable role in transitional management for legacy sectors and in developing the circular economy. The practices of the Zhengzhou Commodity Exchange (ZCE), Dalian Commodity Exchange (DCE), and Shanghai Futures Exchange (SHFE) demonstrate different governance paths.

ZCE's "Standard Implantation" Model. ZCE's innovation lies in smartly "implanting" environmental regulatory requirements into futures contract design. Taking rapeseed oil futures as an example, the exchange revised delivery rules to grant delivery convenience or price premia to rapeseed oil produced using more energy-efficient and environmentally friendly processing technologies (ZCE 2023). This seemingly minor technical adjustment embodies profound governance logic: it transforms the abstract requirement of "environmental protection" into a "market advantage" that enterprises can clearly perceive. To gain a more favorable position in futures delivery, enterprises are incentivized to proactively invest in energy-saving technological retrofits. This market-based incentive changes the logic from "I am compelled to comply" to "I want to comply," significantly reducing the administrative supervision costs for the government. Data show that in 2023 alone, this measure led to a significant reduction in energy consumption in related industries. The cumulative delivery volume of rapeseed oil futures reached 309,700 tons in the same year, demonstrating the market's high acceptance of the green standard (ZCE 2024).

The "Whole Industrial Chain Risk Management" Model of DCE and ZCE. DCE and ZCE provide a "safety cushion" for the smooth green transformation of traditional energy-intensive industries by constructing complete chemical futures chains. By listing upstream raw material futures such as pure benzene and propylene and linking them with existing downstream product futures such as styrene and polypropylene, chemical enterprises can conduct systematic joint hedging for the entire chain from raw material procurement to product sales. Under the background of energy transition and increasingly stringent environmental requirements, traditional industries face enormous operational uncertainty. This model provides valuable certainty for enterprises through financial tools, enabling them to stabilize operations, avoid production interruptions and even large-scale unemployment caused by sharp price fluctuations, and thus ensure economic and social stability during the green transition process. Data show that with the support of futures tools, green technology transformation investment in the chemical industry achieved a significant year-on-year increase in 2024, far exceeding the average for the manufacturing sector, fully illustrating that effective risk management is the source of confidence for enterprises making long-term green investments (Shanghai Securities News 2023).

SHFE's Exploration of ESG Performance Incentives. Research on the impact of crude oil futures price fluctuations at the Shanghai International Energy Exchange (INE, a subsidiary of SHFE) on the environmental, social, and governance (ESG) performance of companies in the same industry indicates that firms strategically improve their ESG performance in response to shocks from crude oil futures prices (Zhang et al. 2024). This suggests that futures markets not only reflect commodity prices, but can also incentivize enterprises to pay greater attention to and improve their sustainable development performance through market signals.

3.4 Practicing Inclusive Growth: "Insurance + Futures" as an Inclusive Finance Tool

The governance value of futures markets is not only manifested at the macro industrial level, but also penetrates into the "capillaries" of the social structure through the innovative "Insurance + Futures" model, serving as a tool for social policy and redistribution. This model is a practical implementation of the principles of inclusivity and equity that are central to sustainable development.

The core logic is that an insurance company designs a product for farmers that guarantees the selling price of their agricultural products. The insurance company then hedges the price risks it has undertaken by purchasing corresponding exchange-traded options and other tools in the futures market (Luo and Zhong 2020). For individual farmers, the threshold for directly participating in complex futures trading is prohibitively high. The "Insurance + Futures" model cleverly packages the professional risk

management function of futures markets into a simple and understandable insurance product and delivers it precisely to agricultural producers most in need of risk protection. This is a typical practice of inclusive finance and an innovative attempt by the government to provide quasi-public goods (risk protection) to dispersed and vulnerable social groups through market mechanisms (Beck et al. 2007).

The social effectiveness of this model is significant. Taking the apple project in Fu County, Shaanxi Province as an example, with the support of ZCE, the project covered 1,793 fruit farmers, more than 28% of whom were registered poor households. When apple market prices fell, the project ultimately paid out CNY 18 million to the farmers, with a payout ratio as high as 131% and an average payment of nearly CNY 10,000 per household, effectively stabilizing their income (Founder CIFCO Futures 2019). The apple project in Jingning County, Gansu Province was even larger in scale, with total payouts exceeding CNY 40.76 million and a payout ratio of 180.69%, resulting in an average payment of more than CNY 6,900 per household and becoming a classic case of serving rural revitalization (Nanhua Futures 2023). This model not only stabilizes farmers' incomes and enhances their ability to cope with market price fluctuations and natural disasters, but more importantly links the outcomes of modern financial markets closely to the well-being of grassroots society, vividly interpreting the profound connotation of financial services supporting the national strategy of "common prosperity."

4. Mechanism Analysis: The Collaborative Governance Logic of China's Green Futures Practice

The previous section described the diverse landscape of China's green futures market. This section aims to probe into its internal mechanisms, systematically analyzing the transmission pathways of this new governance tool from economic, environmental, and social dimensions, and extracting its unique paradigm of collaborative governance.

4.1 Economic Dimension: Transmission from Price Signals to Industrial Chain Resilience

The economic contribution of futures markets to sustainable development first generates a "multiplier effect" through their powerful price signaling function. The "green premium" formed by green futures varieties—that is, the market-based price advantage enjoyed by products that meet sustainability standards—not only directly incentivizes individual production enterprises to undergo green transitions, but also operates through industrial-chain transmission to channel larger-scale social capital into green sectors (Hong and Kacperczyk 2009). When capital markets discover that green assets can achieve better liquidity and price discovery through futures markets, their inclination to allocate toward related assets increases. By the end of 2024, there were 350 green-themed funds in China, with a total scale exceeding CNY 310 billion. The investment decisions of these funds largely refer to the price signals provided by futures markets, forming a capital guidance closed loop from financial markets to the real economy (Asset Management Association of China 2024).

Second, the risk management function of futures markets acts as an "industrial chain stabilizer." Against the backdrop of rising global economic uncertainty and normalized volatility in commodity prices, the risks associated with the green transition are particularly salient. By providing a rich array of hedging tools, futures markets enable enterprises to convert uncertain price risks into certain operating costs, thus stabilizing their production plans, investment expectations, and employment (Stulz 1996). The "certainty" obtained by microeconomic entities aggregates into resilience at the macroeconomic and industrial-chain levels. It ensures that during the transition toward a sustainable development model, the economic system can withstand external shocks and avoid severe fluctuations caused by transformation pains.

4.2 Environmental Dimension: A "Twin-Engine" of Market Incentives and Environmental Regulation

In the environmental dimension, the core governance mechanism of green futures markets lies in the effective internalization of environmental costs. Taking the carbon emission allowance futures that are the subject of intense research as an example, they price the core environmental factor of "carbon" through market transactions, making the cost of carbon emissions—previously ignored by enterprises and society—explicit and asset-like (Qi and Lin 2018). Once carbon emission allowances have a continuous and transparent forward price curve, they cease to be abstract environmental slogans and instead become assets or liabilities that must be carefully managed on enterprises' balance sheets. This fundamentally changes corporate behavior patterns, incentivizing firms to regard emission reduction as an investment that creates economic value rather than merely a compliance cost.

Furthermore, the development of futures markets makes a more efficient and refined "twin-engine" environmental governance model possible. This cross-market linkage provides policymakers with an innovative regulatory lever. For example, regulators could construct a synergistic "dual-market linkage" governance mechanism: when monitoring shows that carbon market prices are too low and emission reduction constraints are insufficient, they could increase margin requirements or transaction fees for high-carbon varieties (e.g., coal) in the futures market, thereby transmitting a tightening signal to the real economy. Conversely, when it is necessary to stimulate more ambitious emission reductions, both market tools can be used synergistically. This dynamic, coordinated regulation based on market signals is undoubtedly more flexible, efficient, and precise than traditional static administrative orders.

4.3 Social Dimension: Reshaping from Consumer Welfare to Corporate Governance

The governance value of futures markets ultimately transmits to the social level, reflected in their promotion of social equity and the reshaping of corporate governance.

First, by stabilizing upstream raw material prices, futures markets act as a "buffer" to protect consumer welfare and maintain social stability. For example, the smooth operation of basic chemical raw material futures such as pure benzene and propylene provides price risk management tools for downstream consumer goods industries such as plastics, textiles, and daily chemicals. This effectively curbs sharp increases and decreases in terminal consumer prices caused by drastic fluctuations in raw material prices, thereby protecting the immediate interests of the general public under inflationary pressures. At the same time, as mentioned earlier, inclusive finance models such as "Insurance + Futures" extend the risk protection function of financial markets to vulnerable groups, promoting equitable access to financial services—an important institutional arrangement for achieving inclusive growth (Beck et al. 2007).

Second, participation in futures markets profoundly promotes the modern transformation of corporate governance structures. Once enterprises incorporate futures tools into their day-to-day operational decisions, their governance philosophy undergoes a systematic shift. First, their decision-making horizon becomes more long-term, shifting from chasing short-term spot price fluctuations to managing long-term risks and opportunities based on the forward price curve. Second, their risk management systems become more systematic, with futures hedging integrated into comprehensive risk management frameworks, thereby enhancing the scientific and robust nature of operations. Third, environmental investment becomes strategic: because green production can bring tangible economic returns through futures markets, environmental investment is transformed from a passive cost item into an active strategic choice to enhance core competitiveness (Tianjin Discipline Inspection Commission 2025). These micro-level governance transformations aggregate to form a solid foundation for society's evolution toward a sustainable development model.

4.4 A New Paradigm of Collaborative Governance

Synthesizing the above analysis, it becomes evident that behind the practice of China's green futures lies a unique paradigm of tripartite interactive collaborative governance involving the state, the market, and society.

In this paradigm, the state (government) plays the role of "top-level designer" and "ultimate regulator," responsible for setting macro-strategic goals and providing the institutional foundation (Evans 1995). The market (represented by intermediaries such as exchanges and futures companies) plays the role of "institutional executor" and "mechanism innovator," accurately "translating" macro policy intentions into specific, tradable, and hedgeable market rules and financial products. Society (represented by micro entities such as enterprises and farmers) acts as "active responder" and "value creator," autonomously engaging in green innovation and sustainable practices in response to market signals. These three parties each play their roles while empowering one another, forming a governance ecosystem that is more resilient and adaptive than the simple binary relationship of "regulator" and "regulated."

This paradigm transcends the traditional principal–agent supervision model. The government is no longer merely a principal issuing commands, but acts as a "meta-governor," shaping the institutional environment and strategic direction. This governance model of "embedded autonomy" (Evans 1995)—where the state is deeply embedded in market operations through institutions such as exchanges while retaining strategic autonomy to guide markets toward long-term national goals—offers a fruitful Chinese solution to complex governance challenges such as the sustainable transition.

5. Progressing with Stability: Challenges and Optimization Paths for Sustainable Governance

Although China's green futures market has achieved remarkable results in serving sustainable development, as an emerging governance field it still faces multiple challenges at the levels of governance foundations, frameworks, and objectives. Identifying and addressing these challenges is a necessary path for constructing a modern sustainable financial governance system.

5.1 Foundational Challenges: Data Deficits and Information Asymmetry

The accurate pricing and effective operation of green futures are highly dependent on high-quality, standardized, and verifiable environment-related data, such as corporate carbon emissions, energy consumption, and pollutant emissions. However, China's environmental data infrastructure is still relatively weak, with a significant "data deficit." This is manifested in inconsistent data standards, differing statistical calibers, barriers to cross-departmental data sharing, and shortcomings in data timeliness and accuracy. For example, during the research and development of power futures, GFEX faced challenges such as fragmented regional power data and difficulty in accurately measuring the value of electricity differentiated by energy structure. Similarly, the launch of carbon emission allowance futures urgently requires a sound Monitoring, Reporting, and Verification (MRV) system for emission data as support (IIGF 2024).

From the perspective of public governance theory, high-quality environmental data has the typical attributes of a public good. Individual enterprises lack sufficient incentives to produce and share such data, leading to underprovision in the market. The lack of foundational data not only affects the scientific nature of futures contract design and the effectiveness of pricing, but also exacerbates information

asymmetry, creating room for "greenwashing" behavior in which enterprises exaggerate their sustainability performance to gain undue benefits, thereby undermining market credibility and resource allocation efficiency (Delmas and Burbano 2011).

5.2 Framework-Level Challenges: Regulatory Innovation and Coordinated Efficiency

As a cross-sectoral innovative governance tool, green futures also create regulatory needs that go beyond those of traditional financial supervision, thus challenging the existing regulatory framework. At present, China's futures regulatory system is mainly designed for traditional commodities, and paid insufficient attention to the specific characteristics of environmental-rights-based futures. This "new regulatory demand" is mainly reflected in three aspects.

First, it is necessary to establish cross-departmental coordination mechanisms. The regulation of green futures (especially carbon emission allowance futures) involves multiple departments, including the CSRC (financial market supervision), the Ministry of Ecology and Environment (environmental rights definition), and the National Development and Reform Commission (energy and industrial policy). Without an efficient, regularized mechanism for cross-departmental joint decision-making and information sharing, policy conflicts or regulatory vacuums may readily emerge, leading to a situation of "fragmented governance."

Second, cross-border regulatory rules need to be formulated. As China's financial markets continue to open up, institutional gaps have yet to be fully filled concerning how to coordinate domestic rules for highly internationalized green-related varieties (such as platinum and palladium) with foreign regulatory regimes, how to facilitate participation by overseas investors, and how to prevent risks arising from cross-border capital flows (Zetzsche et al. 2017).

Third, stronger coordination is needed in ESG-related regulation. The green standards set in futures markets have not yet been effectively integrated with regulatory systems in other sustainable finance sectors, such as listed companies' ESG information disclosure, green bond certification, and green credit standards. As a result, the policy synergies are not fully realized (GFEX 2025).

5.3 Goal-Level Challenges: Imbalanced Participation and Insufficient Inclusiveness

From the perspective of governance goals, an ideal green futures market should provide inclusive risk management functions, and the fruits of its development should be broadly shared across all sectors of society. However, current market practice shows a structural imbalance in participation: real-sector enterprises, especially small and medium-sized enterprises (SMEs), are underrepresented. Studies have shown that many SMEs find it difficult to effectively use futures tools for hedging due to a lack of specialized personnel, limited financial resources, and weak risk management awareness.

This imbalance in participation can have two negative consequences. First, insufficient participation by real-sector enterprises (especially SMEs) may weaken the effectiveness of the price discovery function, causing futures prices to deviate from industrial fundamentals, widening basis risk, and ultimately harming these enterprises. Second, it undermines the inclusiveness of governance: risk management as a quasi-public good fails to fully benefit those who need it the most, thereby to some extent deviating from the governance goals of "common prosperity" and inclusive growth.

5.4 Optimization Paths: Building a Modern Sustainable Financial Governance System

In response to the above challenges, it is necessary to propose optimization paths systematically from the perspective of modernizing the national governance system and governance capacity.

Consolidating Data Infrastructure and Strengthening Public Goods Provision. It is recommended that a national-level, authoritative and unified "National Green Data Infrastructure Platform" be established under state leadership to integrate data resources from departments such as energy, environmental protection, meteorology, and industry and information technology, and to establish standardized data sharing and disclosure mechanisms. Technologies such as blockchain can be used to ensure data authenticity and traceability. The government should assume the core responsibility for providing this critical public good, thereby laying a solid foundation for the effective operation of the market .

Innovating Regulatory Tools and Enhancing Governance Adaptability. Faced with rapidly developing financial innovation, the regulatory system needs to shift from a "control-oriented" to an "adaptive" model. It is recommended to introduce "regulatory sandbox" mechanisms, providing a controlled-risk testing environment for major innovative products such as carbon futures and power futures (Zetzsche et al. 2017). At the same time, special Regulatory Guidelines for Green Futures Products should be formulated as soon as possible, and a regularized cross-departmental coordination and consultation mechanism should be established. In terms of external opening-up, innovative arrangements such as pilot "mutual recognition of green certificates" can be explored, leveraging institutional advantages in regions such as the Guangdong–Hong Kong–Macao Greater Bay Area to steadily enhance the internationalization level of the market.

Fostering an Inclusive Market Ecosystem and Balancing Efficiency with Equity. To address participation imbalances, joint efforts are required from government, exchanges, and market institutions. Exchanges should continuously optimize contract design—for example, by promoting GFEX's experience of allowing multiple delivery methods in platinum and palladium futures contracts—to lower participation thresholds for SMEs (GFEX 2025). More importantly, it is essential to vigorously develop and promote

the "futures social worker" service model. Drawing on social work concepts, this model involves futures companies and other professional institutions forming service teams that reach deeply into industrial clusters and SMEs to provide customized, hands-on risk management training and solution design. This represents an innovative extension of the "service-oriented government" concept in the financial domain. The government can support this model through service procurement and subsidies, ensuring that professional financial services are delivered precisely to the "capillaries" of the economy, so that the fruits of sustainable development effectively benefit a broader array of social groups (Luo and Zhong 2020).

6. CONCLUSION: IMPLICATIONS OF CHINA'S PRACTICE FOR PUBLIC ADMINISTRATION THEORY

6.1 Responding to the "Big Question": Reassessing the Governance Value of Futures Markets

Using the innovative practice of China's green futures market as a "small incision," this paper has examined the "big question" of the role of financial markets in the modern state governance system. The core finding is that futures markets are far from being merely traditional economic venues for resource allocation; they are evolving into sophisticated governance tools capable of carrying and achieving complex public objectives. Through a systematic analysis of China's practice, this paper demonstrates three key roles that futures markets play in sustainable development governance:

A "Steering Wheel" for Strategic Guidance. Through their forward-looking price discovery function, futures markets provide clear market signals for long-term investment in green and low-carbon sectors, effectively guiding the direction of economic restructuring (Fama 1970).

An "Accelerator" for Industrial Transformation. Through their systematic risk management function, futures markets offer a "safety cushion" for enterprises experiencing the pains of transition, enhance industrial chain resilience, and enable companies to undertake long-term green technological innovation and investment (Bartram et al. 2011).

A "Safety Valve" for Social Risk. Through mechanisms such as standard embedding and inclusive finance, futures markets foster low-cost corporate self-discipline and, by stabilizing prices and safeguarding livelihoods, help defuse potential social tensions arising during the transition process (Beck et al. 2007).

These findings have important implications for public administration theory. They require us to broaden the traditional conception of the "policy toolkit" and to include complex financial derivatives such as futures and options within the scope of public governance research. Future studies in public administration need to investigate more deeply the interaction between the internal logic of financial markets and administrative action, and to analyze how these market-based tools can be more effectively designed and utilized to achieve public interest goals.

6.2 The Uniqueness of the Chinese Model and Its Global Significance

The success of China's green futures practice stems from its unique model of state–market interaction, which offers valuable experience for global sustainable governance. This model is neither a pure free-market approach nor the direct intervention associated with some Western contexts, but can be summarized as a new governance paradigm of "state-constituted market empowerment."

In this paradigm, the core role of the "state" is to "constitute" rather than "substitute." The government clearly defines strategic goals through top-level design and provides key public goods such as the rule of law framework and data infrastructure, thereby creating the preconditions for market emergence and development. Once the market framework is constructed, the "market" is fully empowered, and its internal efficiency, innovative dynamism, and decentralized decision-making mechanisms are activated to explore concrete pathways for achieving public goals in the most economical way. The relationship between state and market is one of mutual embeddedness and mutual enablement (Evans 1995).

This model offers important insights for developing countries exploring their own modernization paths. In the context of globalization and marketization, how to maintain strategic autonomy while leveraging global financial markets to serve national sustainable development objectives and effectively prevent financial risks is a common challenge. China's green futures practice contributes a Chinese solution infused with Eastern wisdom to this challenge, one that differs from both neoliberalism and traditional statism.

6.3 Directions for Future Research

As a preliminary exploratory study, this paper also opens up several promising directions for future in-depth research:

Deepening Theoretical Research. The "governance contract" concept proposed in this paper requires further theoretical elaboration and scholarly development. Future research can systematically examine its connotation, characteristics, and operating mechanisms from the perspectives of contract theory, public economics, and administrative law (Hull 2019).

Expanding Practical Domains. As more products involving public goods and public risk management—such as power futures, data futures, and weather index futures—continue to emerge, it is an important

practical question whether the governance analysis framework proposed here has broader applicability and how it should be adjusted to account for the distinctive features of different sectors (Zeng and Kang 2020).

Strengthening International Comparison. Systematic comparative studies between China's green futures practice and market-based environmental governance experiences in other economies—such as the EU Emissions Trading System (EU-ETS) and the U.S. Regional Greenhouse Gas Initiative (RGGI) (Ellerman et al. 2010)—will help to better understand the strengths, conditions of applicability, and evolutionary paths of governance models under different institutional environments, and thus contribute more universally applicable knowledge to global sustainable governance.

In conclusion, as the sustainable development transition enters deep waters, innovating public governance tools has become an imperative of the times. China's exploration in green futures not only injects new impetus into its own high-quality development, but also offers the world a Chinese solution—rich in Eastern wisdom—on how to use the "hand of the market" to realize the "way of governance."

Data sharing agreement

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

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