DERIVATIVES LAWS AND REGULATIONS FOR ALTERNATIVE ASSET MANAGERS

DERIVATIVES & CLIMATE RISK: HOW ENVIRONMENTAL SHOCKS RESHAPE GLOBAL MARKETS

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Overview

Introduction

Climate change, and our attempt to tackle its incidence and impacts, has emerged as a defining challenge for the global financial system, posing material risks to asset values, market functioning, and macroeconomic stability. As governments, regulators, and private actors increasingly reckon with the financial implications of a warming planet, and volving technologies, policies and behaviours, derivatives markets have become both a focal point and a potential tool for climate risk management. These markets, which are essential for hedging, price discovery, and capital allocation, are not immune to the disruptive forces of climate-related risk.

In recent years, climate-related financial risks have transitioned from a peripheral concern to a central theme in regulatory discourse and market strategy. The complexity and interconnectedness of modern financial systems—particularly those involving derivatives—mean that the impact of climate risk can cascade through multiple layers of financial intermediation. Derivatives not only reflect but also amplify market signals and exposures, making their role in managing systemic and firm-level climate risk particularly salient.

This chapter introduces the themes and analytical framework that will guide the exploration of climate risk management within derivatives markets. It lays the groundwork for a more detailed examination of how climate risks are transmitted into derivatives markets, how these markets are evolving to respond, and how regulatory regimes across jurisdictions are adapting to manage the associated risks.

To this end, the chapter proceeds as follows. First, it outlines the categories of climate-related financial risks—physical, transition, and liability—and explains how each can influence market participants and infrastructure. Next, it provides a high-level view of derivatives markets and the channels through which climate risk manifests in these markets. Finally, it previews the core regulatory and policy developments that are shaping the future of climate risk governance in the derivatives space.

The objective is not only to underscore the importance of climate and climate transition risk for market participants and regulators but also to position derivatives as both a locus of vulnerability and a critical component of the toolkit for navigating the climate transition. This duality—derivatives as both risk transmitters and risk mitigants—will be a recurring theme throughout the work.

Understanding Climate-Related Financial Risks

The identification and categorization of climate-related financial risks form the foundation for effective climate and transition risk management. These risks manifest in several distinct but interconnected forms, each posing unique challenges to financial institutions, market participants, and regulators. In the context of derivatives markets, understanding these categories is essential for assessing exposure, pricing risk, and designing mitigation strategies.

A. Physical Risks Physical risks refer to the direct impacts of climate change, such as rising sea levels, increased frequency and severity of extreme weather events, droughts, floods and wildfires. These risks can damage infrastructure, disrupt supply chains, impair agricultural output, and lead to significant economic losses. For derivatives markets, physical risks can influence the value and volatility of underlying assets—particularly commodities and real assets—and thereby affect pricing, margining, and counterparty exposure.

B. Transition Risks Transition risks arise from the policy, legal, technological, and market shifts that occur as economies transition toward lower-carbon models. Direct support for innovation and deployment of clean technologies as well as regulatory changes such as carbon pricing, emissions and efficiency standards, and sustainability disclosure requirements can rapidly alter market valuations. Likewise, shifts in consumer preferences and the emergence of disruptive technologies can impact corporate profitability and sectoral performance. Economies of scale and network effects mean these risks are not independent but are strongly correlated. For example, a cost-reducing clean technology breakthrough is more likely to materialise in a policy environment supportive of clean technologies, and a policy environment supportive of clean technologies is more likely to endure in the presence of low-cost clean technology options. This reinforcing feedback can lead to substantial and rapid repricing across asset classes, which can, in turn, be reflected in derivatives pricing and market behavior.

C. Liability Risks Liability risks stem from potential legal claims related to climate change. Companies may face lawsuits for failing to mitigate known environmental harm or for insufficient disclosure of climate-related risks. Such liabilities can influence creditworthiness and corporate behavior, potentially triggering events of default or valuation adjustments that propagate through derivatives contracts.

Transmission Channels into Derivatives Markets Climate-related risks enter derivatives markets through several transmission channels:

Asset Valuation: Changes in perceived physical or transition risk can affect the fair value of underlying assets.

Volatility: Increased uncertainty and event-driven market reactions can raise volatility, impacting option pricing and risk metrics.

Liquidity Risk: Climate shocks or regulatory shifts can affect market liquidity, particularly in less actively traded instruments especially during banking and liquidity crises.

Counterparty Risk: The financial health of counterparties can be affected by their climate exposures, influencing credit risk assessments in OTC derivatives and hedging instruments.

Understanding these risk categories and transmission channels is critical for developing a comprehensive risk management framework. The following chapters will build upon this foundation by examining how derivatives markets reflect and respond to these risks, and how evolving regulatory structures are addressing the climate challenge.

Climate Risk Exposure in Derivatives Markets

Climate risk is increasingly recognized as a material factor in the valuation and trading of derivatives. Derivatives markets are exposed to climate-related risks through a variety of instruments and sectors. For example, climate variability and policy shifts directly affect energy and agricultural markets. Derivatives on oil, natural gas, wheat, soybeans, and other commodities are sensitive to both physical disruptions such as droughts and hurricanes, as well as to transition policies like emissions caps and renewable subsidies.

Weather derivatives, designed to hedge weather-related exposures, are becoming increasingly relevant as extreme weather events grow in frequency. Although they do not hedge all forms of climate risk, they provide a partial buffer for sectors such as agriculture, energy, and insurance. Carbon futures and options have also emerged as critical instruments for hedging regulatory exposure and price risk in carbon markets. These contracts reflect the monetization of transition risk and the growing role of climate pricing mechanisms in market behavior.

Derivatives play a dual role in the climate finance ecosystem. On the one hand, they offer essential tools for hedging exposures to climate-driven volatility. On the other hand, leveraged positions and complex interdependencies can amplify market instability when climate-related shocks occur. This duality underscores the need for careful scrutiny of risk concentration, counterparty dependencies, and collateral dynamics.

A significant challenge in climate risk management in derivatives lies in data and modeling limitations. Accurate climate risk pricing depends on robust data related to emissions, forward-looking climate scenarios, and asset-level exposures. However, the current market suffers from a lack of standardized, granular, and timely climate data. Furthermore, traditional financial risk models may understate the tail risks associated with climate change. This necessitates enhancing scenario analysis and integrating climate factors into stress testing frameworks.

Emerging Regulatory Frameworks and Market Standards

Regulatory approaches to climate risk in derivatives markets are rapidly evolving. Policymakers around the world are responding to the growing recognition that unmanaged climate risk poses not only a threat to individual institutions, but to the financial system as a whole. This chapter surveys the international and domestic regulatory initiatives that are reshaping how derivatives markets address climate-related risks.

Internationally, organizations such as the Network for Greening the Financial System (NGFS), the Financial Stability Board (FSB), and the International Organization of Securities Commissions (IOSCO) have laid foundational principles for integrating climate risk into financial regulation. Their work has spurred the development of taxonomies, disclosure frameworks, and risk assessment methodologies that inform domestic regulatory efforts.

In the European Union, regulators have advanced a comprehensive sustainable finance strategy that includes the EU Taxonomy Regulation and the Sustainable Finance Disclosure Regulation (SFDR). These initiatives aim to standardize climate-related disclosures, enhance transparency, and channel capital toward greener activities. In the derivatives context, the European Securities and Markets Authority (ESMA) has begun evaluating how climate risks affect clearinghouses, trading platforms, and market participants.

In the United States, the Commodity Futures Trading Commission (CFTC) has taken a leadership role through the establishment of its Climate Risk Unit (CRU), which focuses on examining climate-related market risk and promoting the development of climate-related derivatives. The Securities and Exchange Commission (SEC) has also proposed climate disclosure rules that, if implemented, would have significant implications for derivatives linked to corporate issuers.

The United Kingdom and other jurisdictions are similarly moving forward with climate-aligned financial regulation. UK authorities are integrating climate scenarios into stress testing frameworks, while other countries are exploring how to incorporate climate metrics into prudential regulation and market oversight.

Climate risks can also compromise the solvency or credit profile of counterparties, particularly those in carbon-intensive sectors. Over-the-counter derivatives markets may face increased credit risk due to the uneven climate exposures among participants. These dynamics reinforce the systemic importance of climate-aware margining, netting, and collateral management. Climate risk is not merely an external force acting upon derivatives markets; it is increasingly an intrinsic component of market dynamics that must be actively priced, managed, and regulated.

One common theme across jurisdictions is the effort to integrate climate risk into capital adequacy standards, stress testing, and supervisory expectations. This includes reassessing the risk weights of assets vulnerable to climate change and ensuring that financial institutions incorporate climate considerations into their internal risk controls.

Regulators are also supporting the development of voluntary market standards. These include initiatives to standardize the documentation of sustainability-linked derivatives and to improve transparency around the carbon content of underlying assets. As the regulatory landscape matures, market participants will need to keep pace by aligning internal governance and risk practices with external expectations.

Market Infrastructure and Risk Management Practices

The infrastructure of derivatives markets—exchanges, clearinghouses, and central counterparties (CCPs)—plays a central role in shaping the response to climate risk. As the frequency and intensity of climate-related financial events increase, these institutions must adapt their risk management frameworks to account for new and evolving vulnerabilities.
CCPs are at the heart of the post-crisis regulatory architecture and bear primary responsibility for mitigating systemic risk. In the climate context, this means enhancing margin models and stress testing frameworks to incorporate plausible climate scenarios. These efforts must address both short-term shocks and longer-term transition risks that could affect market volatility and participant solvency.

Exchanges are also facilitating market responses to climate risk by introducing new products tied to climate benchmarks and sustainability indices. Carbon allowances, renewable energy certificates, and ESG-index derivatives are becoming increasingly common on major trading platforms. These products not only provide hedging tools for climate-related exposures but also support market-based approaches to emissions reduction.

Clearing firms and futures commission merchants (FCMs) are beginning to disclose their climate-related risks and integrate them into operational risk frameworks. Enhanced disclosures promote market discipline and support a more accurate pricing of climate-related exposures. However, much work remains in standardizing the metrics and methodologies used to assess and report these risks.

Effective climate risk management in derivatives markets requires integration across all layers of financial infrastructure. This includes embedding climate factors into risk models, revising capital and collateral policies, and updating governance structures to reflect the heightened importance of sustainability. As climate risk becomes a more prominent feature of market dynamics, the resilience of the derivatives ecosystem will increasingly depend on the capacity of its infrastructure to adapt.

Challenges and Gaps in the Current Framework

Despite significant progress in integrating climate risk into derivatives markets, several challenges continue to limit the effectiveness and consistency of current practices. A prominent issue is the lack of standardized metrics and definitions for assessing climate risk in derivatives. Without a shared language or taxonomy, market participants struggle to compare and evaluate exposures across asset classes, counterparties, and jurisdictions.

Data asymmetry further compounds the challenge. Many financial institutions rely on fragmented, backward-looking, or self-reported data that may not capture the full scope or future trajectory of climate-related risks. Backward looking data and derived probability distributions offer poor guides to future structural shocks and transformations. This lack of consistent and forward-looking climate data hampers risk modeling, limits transparency, and reduces the accuracy of pricing mechanisms in derivatives markets.

In addition to data limitations, scenario analysis and stress testing capabilities remain underdeveloped. Traditional models often exclude or underestimate the non-linear and long-horizon nature of climate-related financial risks. As a result, current methodologies may fail to capture the true magnitude of potential losses, particularly under scenarios involving abrupt policy changes (as with the reinforcing policy-technology-behaviour feedbacks and economies of scale in production and discovery), or rapid environmental deterioration (as with climate feedbacks and irreversible thresholds and tipping points such ice melt, leading to higher radiative absorption, carbon sink ecosystem die-backs and methane release from melting tundra).

Legal uncertainties surrounding climate-linked derivatives present another obstacle. Novel instruments, such as sustainability-linked derivatives or carbon-credit-based products, often operate within ambiguous legal frameworks. Issues related to enforceability, contractual interpretation, and jurisdictional variation can introduce additional risks, particularly in the event of dispute or default.

Systemic risk amplification is also a growing concern. The interconnected nature of derivatives markets means that climate shocks affecting a key sector, asset class, or geographic region can quickly cascade through the system. Inadequate collateral practices, concentrated exposures, or insufficient counterparty risk controls can turn localized climate events into market-wide disruptions.

Addressing these gaps will require coordinated efforts from regulators, market participants, and standard-setting bodies. It will also demand continued innovation in financial modeling, data collection, legal structuring, and policy design. The next section will consider the path forward and offer recommendations for enhancing the resilience and responsiveness of derivatives markets to the realities of climate risk.

Future Outlook and Policy Recommendations

Looking ahead, the effective management of climate-related risks in derivatives markets will depend on the alignment of policy frameworks, regulatory oversight, and market innovation. A forward-looking strategy must begin with the enhancement of climate-related disclosures. Comprehensive and standardized reporting requirements will enable more accurate pricing of risk, improve market transparency, and support better-informed decision-making by investors and counterparties.

Promoting standardization of climate-linked derivatives contracts is equally important. This includes not only contractual language and performance metrics but also methodologies for verifying climate outcomes. Clear definitions and benchmarks for key terms such as carbon intensity, emissions reduction targets, and sustainability triggers are needed to ensure that these instruments function as intended and maintain legal robustness.

Encouraging financial innovation in climate hedging tools is another critical area. Market participants should be incentivized to develop instruments that address sector-specific risks and that can be tailored to diverse transition scenarios. New product development should be supported by regulatory flexibility and legal clarity, while being grounded in sound risk management principles.

Supervisory capacity must also evolve. Regulators need the expertise and tools to assess the climate resilience of derivatives portfolios and infrastructure. This may include developing bespoke supervisory stress tests, increasing cross-agency collaboration, and integrating climate risk into routine supervisory reviews.

Finally, the harmonization of regulatory approaches across jurisdictions will be essential to avoid regulatory arbitrage and ensure consistent treatment of climate risk in globally interconnected derivatives markets. International coordination can foster best practices, facilitate information sharing, and create a level playing field for market participants operating in multiple regions.

Both adaptation to climate damages and emissions reductions programmes have public good elements on account of network effects and pervasive market failures. For example, private individuals may not have the incentive to spend adequate amounts on flood defences from which others will benefit, and therefore be inclined to free ride. Investment in energy, transport and urban infrastructure also requires a degree of central coordination and investment. This makes key sectors highly sensitive to policy, planning and regulation. In turn, this enhances the returns to clear, consistent and credible government strategies which help contain, quantify and manage risk, facilitating derivative pricing.

The climate challenge is complex, urgent, and dynamic. It requires a commensurate response from policymakers, regulators, and financial institutions. Derivatives markets, given their scale and intermediation role, have a critical part to play in the transition to a more sustainable global economy. The path forward must be grounded in prudence, innovation, and a shared commitment to financial and environmental resilience.

Conclusion

As climate change reshapes the landscape of financial risk, derivatives markets stand at a critical juncture. These markets are not insulated from environmental pressures; instead, they are deeply interwoven with the systems and institutions that must adapt to a changing climate. The growing salience of climate-related financial risks has revealed both vulnerabilities and opportunities within the derivatives ecosystem. This work has explored how these risks permeate the structure and function of derivatives markets, and how regulators and market participants are beginning to respond.

Throughout this analysis, a central theme has emerged: derivatives markets serve as both a conduit for and a countermeasure to climate risk. They can transmit shocks through leverage, interdependence, and concentrated exposures. Yet they also offer tools for hedging, for redistributing risk, and for channeling capital toward more sustainable outcomes. The challenge ahead lies in ensuring that the balance tilts firmly toward resilience and utility, rather than fragility and opacity.

While regulatory responses are still evolving, the direction of travel is clear. Enhanced disclosure, standardized products, improved data, proactive supervision and coordinated public policy are no longer optional—they are foundational to a derivatives market that can withstand climate shocks and support an orderly transition to a low-carbon economy. The integration of climate considerations into capital, collateral, and conduct frameworks is no longer theoretical; it is a practical imperative.

The road ahead will demand collaboration across public and private sectors, across jurisdictions, and across disciplines. Legal, regulatory, and financial innovation must go hand in hand. Only through sustained effort and alignment of incentives can derivatives markets fulfill their potential as instruments of climate risk mitigation, adaptation, and accountability.

Author Biography

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Dimitri Zenghelis is Special Advisor for the Wealth Economy Project, which he previously co-founded and led, at the Bennett Institute, University of Cambridge and is a Senior Visiting Fellow at the London School of Economics. He is a Senior Associate at the Cambridge Institute for Sustainability Leadership. He was until recently Head of Policy at the Grantham Research Institute at the LSE and Acting Chief Economist for the Global Commission on the Economy and Climate.

Previously, he headed the Stern Review Team at the Office of Climate Change, London, and was a lead author on the Stern Review on the Economics of Climate Change, commissioned by the then Chancellor Gordon Brown. He was also Senior Economic Advisor to Cisco's long-term innovation group and an Associate Fellow at the Royal Institute of International Affairs, Chatham House. Before working on climate change, Dimitri was Head of Economic Forecasting at HM Treasury. He advises governments, financial institutions and international organisations (including the UN, World Bank and regional development banks, the Mayor of London and the UK Committee on Climate Change among others) on macroeconomics, sustainable growth, climate change and innovation.

Firm Biography

LSE

The London School of Economics and Political Science (LSE), a world-leading university, specialising in social sciences. LSE was awarded University of the Year 2025 and ranked top in the UK for 2025 and 2026 by the Times and Sunday Times Good University Guide. Based in the heart of London, we are a global community of people and ideas that transform the world.