



Climate risk and its impact on financial markets - a conceptual perspective

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Abstract

The growing urgency to comprehend and manage climate risks extends far beyond the realm of environmental science—it has become a central concern for the global financial system. Climate change presents multidimensional risks that can disrupt asset valuations, strain financial stability, and challenge traditional risk management frameworks. This conceptual study synthesizes existing literature and policy insights to explore climate change as a systemic financial risk, emphasizing both physical and transition dimensions. It examines vulnerabilities in key financial sectors such as banking, insurance, energy, and real estate, while evaluating policy frameworks including the Task Force on Climate-related Financial Disclosures (TCFD) and ESG-based regulations. By drawing from secondary academic and institutional sources, the paper presents a conceptual framework that links climate dynamics with financial system resilience, contributing to policy innovation and future research pathways.

Keywords: Climate risk, Financial stability, Systemic risk, ESG, Transition risk, Sustainable finance

Introduction

The urgency to understand and address climate risks is no longer confined to environmental policies; it now permeates the very fabric of financial and economic systems. Financial markets across the globe are increasingly confronting the complexities and uncertainties generated by climate change. As the global economy becomes more interdependent and capital markets integrate across borders, the ripple effects of climate-induced disruptions pose systemic threats to stability and growth.

Climate risks are not merely environmental issues but financial threats of profound magnitude. The interconnectedness of markets implies that the physical impacts of climate change—such as rising sea levels, wildfires, and floods—and the transition to low-carbon economies together reshape investment patterns, asset valuations, and credit structures. Physical risks involve direct damage to infrastructure and supply chains, while transition risks arise from regulatory, technological, and policy shifts toward decarbonization (Carney, 2015) ^[4]. Both require immediate recognition in financial risk assessments.

The need for this study arises from the growing realization that climate change is transforming from an environmental and humanitarian issue into a systemic financial risk. Frequent and severe climate events have resulted in massive asset losses, insurance claims, and disruptions in productivity across sectors. Simultaneously, policy measures such as carbon pricing and emission regulations create uncertainties for industries dependent on fossil fuels. Inadequate climate-related disclosures and fragmented regulatory frameworks exacerbate the difficulty in managing these challenges effectively.

This study aims to develop awareness of the systemic nature of climate risks, highlight sectoral vulnerabilities, and underscore the importance of integrating climate considerations into existing financial risk management frameworks.

Objectives of the study

- To conceptualize climate risk as a systemic threat to financial stability.
- To analyse vulnerabilities in key sectors such as Banking, Insurance, Energy, and Real Estate.
- To evaluate existing policies and disclosure mechanisms addressing climate risks.
- To explore the role of ESG principles and regulatory frameworks in mitigating risks.
- To propose future strategies for sustainable financial governance.

Literature and theoretical framework

In recent years, scholars and policymakers have increasingly recognized the interlinkages between climate change and financial markets. The notion of climate risk as a *systemic* financial risk has been central to several studies (Battiston *et al.*, 2017) ^[2]. The theoretical foundation rests on the dual dimensions of physical and transition risks.

Physical risks emerge from climate-related disasters and gradual environmental degradation (IPCC, 2022) ^[7]. Such risks directly affect asset valuations, productivity, and infrastructure. Transition risks, conversely, stem from structural economic changes, including policy reforms, technological innovations, and shifts in consumer behavior as economies pursue low-carbon growth (Carney, 2015) ^[4].

Empirical and conceptual studies have shown how both risk types affect global finance. Dietz *et al.* (2016) ^[6] estimated the “climate value at risk” for global financial assets, finding that long-term exposure could wipe out significant portions of global wealth. The Network for Greening the Financial System (NGFS, 2019) ^[11] underscored how financial institutions face material exposures from climate-sensitive portfolios.

Sector-specific research illustrates this further: banks are vulnerable through loans to carbon-intensive industries (Klusak *et al.*, 2021); insurance companies face escalating claims from natural disasters (Monasterolo & Raberto, 2019) ^[10]; and real estate markets experience devaluation in coastal and high-risk areas (Keenan *et al.*, 2018) ^[9].

To promote resilience, policy frameworks like the Task Force on Climate-related Financial Disclosures (TCFD, 2017) ^[13] and the EU Sustainable Finance Taxonomy have sought to enhance transparency and market discipline. However, persistent implementation gaps remain, particularly in ensuring consistent ESG adoption (Bolton *et al.*, 2020; Ameli *et al.*, 2020) ^[3].

This study synthesizes these theoretical insights into a unified conceptual framework that acknowledges climate change as a cross-cutting systemic risk, requiring coordinated financial, regulatory, and policy responses.

Research methodology

This paper adopts a Descriptive, conceptual research methodology, grounded in a qualitative and analytical approach. It synthesizes insights from existing literature, policy documents, and global frameworks to develop a comprehensive understanding of climate risk and its implications for financial markets.

The study examines secondary data from academic literature, policy frameworks, and global reports on climate finance. Given the emerging and multi-dimensional nature of climate risks, a conceptual methodology enables in the synthesis of fragmented knowledge and provides a strong theoretical foundation for future empirical research.

Sources of Data The study has been made using secondary sources, i.e Academic Peer-reviewed journals and various studies on climate- finance, systemic risk, and sustainable financial systems.

Reports and Publications from IPCC reports, World economic Forum publications, IMF and World Bank documents on the climate risks., & Policy Documents from National and international regulations on ESG and climate.

Sectoral vulnerabilities in financial systems

Climate change has profound implications for financial markets and institutions, reshaping how credit, investment, and risk management function across sectors. The physical impacts of climate events—floods, droughts, wildfires, and rising sea levels—combine with transition pressures such as policy shifts, carbon pricing, and technological disruption to create multifaceted financial vulnerabilities. These risks do not exist in isolation; they are deeply interconnected through market

linkages, supply chains, and global capital flows. Understanding these sectoral vulnerabilities is vital for regulators, investors, and policymakers to prevent the amplification of climate shocks into systemic financial crises.

Banking sector

Banks represent one of the most exposed pillars of the financial system when it comes to climate-related risks. Climate change can affect banks through both physical risks (damage to property and infrastructure from extreme weather events) and transition risks (losses from the revaluation of assets and liabilities as the economy moves toward decarbonization).

Physical disasters such as floods, hurricanes, and heatwaves directly impair the value of collateral used to secure loans. For instance, when manufacturing plants or residential properties in flood-prone regions are destroyed or damaged, their market value plummets, eroding the security underlying bank loans. Consequently, non-performing assets (NPAs) increase, squeezing profitability and capital adequacy ratios. A 2023 report by the Network for Greening the Financial System (NGFS) indicated that banks with high exposure to climate-sensitive industries—such as agriculture, construction, and energy—could see loan default probabilities rise by 15–20% under severe physical risk scenarios.

Moreover, banks face growing transition risks as economies decarbonize. Institutions heavily invested in carbon-intensive sectors like coal, oil, and steel face the risk of asset stranding—where once-profitable assets lose value due to regulatory changes, technological shifts, or demand decline (Bolton *et al.*, 2020) ^[3]. For example, the European Central Bank’s climate stress tests (2022) showed that banks with high fossil fuel exposure could face loan losses equivalent to 4% of their total credit portfolio by 2030 under a delayed transition scenario.

Additionally, reputational risk and investor activism increasingly influence banking operations. Banks that continue to fund environmentally damaging projects face public scrutiny and potential withdrawal of capital by ESG-conscious investors. Global financial institutions such as HSBC, BNP Paribas, and Citi have begun aligning lending portfolios with the Paris Agreement goals, demonstrating a gradual but significant transformation in banking strategies. Yet, many regional and domestic banks in emerging economies still lag in integrating climate risk into credit assessments, leaving them vulnerable to shocks.

Insurance sector

The insurance industry stands at the forefront of climate exposure, bearing the brunt of rising catastrophic losses due to extreme weather events. As Monasterolo and Raberto (2019) ^[10] highlight, the increasing frequency and severity of hurricanes, floods, and wildfires challenge the traditional actuarial models that underpin insurance pricing and risk pooling. When climate events become both more intense and less predictable, insurers struggle to accurately estimate premiums, reserves, and reinsurance costs.

Between 2010 and 2023, global insured losses from climate-related disasters doubled, according to Swiss Re Institute (2024), averaging over USD 110 billion annually. Yet, a significant portion of total economic losses remains uninsured, creating a widening “protection gap.” This gap implies that while insurers face growing claims, households and businesses also absorb rising out-of-pocket costs, amplifying financial stress and slowing economic recovery. In some cases, insurers have withdrawn coverage from high-risk regions—such as wildfire-prone areas of California and flood zones in the UK—creating new forms of financial exclusion.

Transition risks also impact insurers’ investment portfolios. Insurance companies typically manage large asset bases, often invested in long-term bonds, real estate, and equities. As the world transitions toward a low-carbon economy, assets tied to fossil fuel production or high-emission industries could lose value, undermining investment returns and capital reserves. European insurers like Allianz and AXA have already started divesting from coal-based assets, signalling a shift toward sustainability-oriented investment strategies. However, such reallocation can also lead to short-term portfolio volatility and valuation uncertainty.

The solvency of the insurance sector, therefore, depends not only on risk-based pricing and reinsurance but also on its capacity to anticipate and adapt to long-term climate trajectories. Regulatory initiatives, including the EU’s Solvency II Directive and the Task Force on Climate-related Financial Disclosures (TCFD), are pushing insurers to disclose climate risk exposure more transparently and build resilience through diversification and adaptive modelling.

Energy sector

The energy sector lies at the heart of both the problem and the solution to climate change. As one of the largest sources of global greenhouse gas emissions, it is subject to intense regulatory scrutiny and profound structural transformation. The transition from fossil fuels to renewable energy is accelerating globally, yet the process introduces substantial financial and operational risks for existing energy companies.

Fossil fuel producers and utilities with significant carbon-intensive assets—such as oil fields, coal mines, and refineries—face the threat of asset stranding as climate policies tighten. According to the International Energy Agency (IEA, 2023), achieving net-zero emissions by 2050 could render up to USD 1.4 trillion in oil and gas assets stranded, resulting in significant write-downs for investors and lenders. This transition risk is further compounded by technological advances in renewable energy, energy storage, and electric mobility, which erode the market share of traditional fossil-based energy firms.

Bolton *et al.* (2020) ^[3] note that policy interventions such as carbon taxes, emission caps, and subsidies for green technology can significantly alter firm valuations and investor behavior. For instance, the introduction of the EU Carbon Border Adjustment Mechanism (CBAM) is expected to shift competitiveness dynamics across global energy and industrial

markets. Companies that fail to innovate or diversify into renewable portfolios risk financial instability or bankruptcy.

At the same time, renewable energy firms are not immune to risk. They face high upfront capital costs, long payback periods, and technological uncertainties. Moreover, supply chain dependencies—for instance, the reliance on rare earth minerals from geopolitically sensitive regions—introduce new dimensions of market risk. Thus, while the energy transition promises long-term sustainability, it requires massive financial realignment, green infrastructure investment, and innovation to ensure both profitability and resilience.

Real estate sector

The real estate sector is among the most visibly affected by physical climate risks, given its direct dependence on geography, land use, and infrastructure resilience. Properties located in coastal regions, floodplains, or drought-prone zones face increasing exposure to climate hazards, leading to depreciation, higher insurance costs, and declining investor interest (Keenan *et al.*, 2018) ^[9].

In the United States alone, the First Street Foundation (2022) estimated that over USD 108 billion in property value could be lost by 2050 due to increased flood risk. Similarly, rising sea levels threaten low-lying coastal regions in South and Southeast Asia, potentially displacing millions and reducing the value of coastal real estate. For financial institutions, this translates into mortgage-backed security (MBS) risks, as property devaluations can impair collateral values and lead to defaults.

Climate change is also reshaping urban planning and investment preferences. Cities and developers are increasingly integrating climate resilience into real estate valuation models—factoring in flood defenses, green spaces, and sustainable building materials. Investors are favouring “green buildings” certified under standards like LEED or BREEAM, which not only reduce environmental impact but also attract higher rental yields and occupancy rates. On the policy side, several governments are linking infrastructure financing to environmental criteria, further incentivizing climate-smart development.

However, the uneven distribution of climate risk creates socio-economic disparities. Low-income communities, often residing in the most vulnerable areas, face higher exposure but lower adaptive capacity. Without targeted policy interventions, such vulnerabilities could lead to long-term displacement, asset inequality, and credit risk concentration in marginalized regions.

Systemic financial implications

The cumulative effect of these sectoral vulnerabilities transcends individual firms and industries, posing a systemic threat to the stability of the global financial system. The Federal Reserve Bank of San Francisco and the Bank for International Settlements have emphasized that climate risk is a source of financial risk, not merely an environmental concern. Because financial markets are highly interconnected, losses in one

sector—such as insurance or real estate—can rapidly spill over into others, amplifying systemic fragility through feedback loops.

For example, widespread defaults in flood-affected regions can erode banks' asset bases, prompt deleveraging and tightening of credit. Simultaneously, insurance companies facing massive payouts may liquidate assets, driving down market valuations. This can create a chain reaction of credit contraction, market volatility, and declining investor confidence. Moreover, sovereign debt may also be affected: countries highly dependent on carbon-intensive exports or vulnerable to natural disasters could experience credit downgrades, raising borrowing costs and constraining fiscal space.

Recognizing these systemic risks, global regulatory bodies such as the Financial Stability Board (FSB), NGFS, and Basel Committee on Banking Supervision have begun integrating climate considerations into macroprudential frameworks. Central banks now conduct climate stress tests, assessing how prolonged physical or transition shocks might impact solvency and liquidity across sectors.

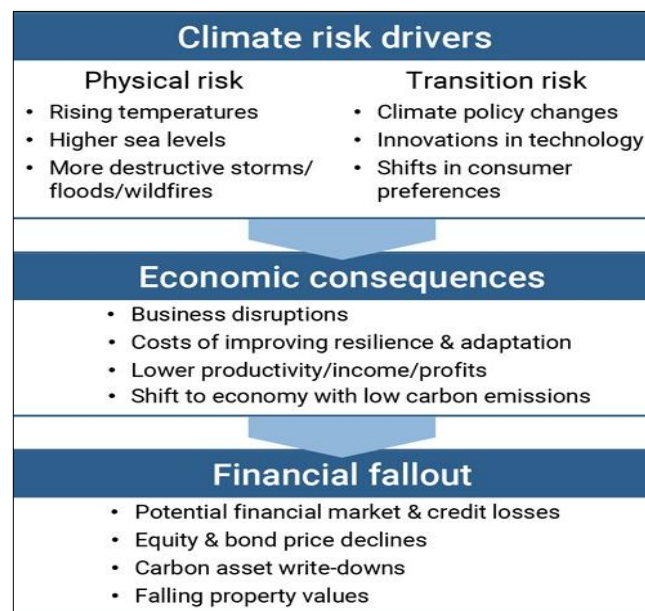
Ultimately, the integration of climate risk into financial governance represents both a challenge and an opportunity. Institutions that adapt early—through sustainable finance, green bonds, and enhanced risk disclosure—can mitigate exposure while capitalizing on emerging opportunities in renewable energy, resilience infrastructure, and carbon markets. Conversely, delayed action could expose financial systems to abrupt, large-scale corrections, endangering both economic growth and global stability.

Climate risks are no longer confined to environmental and humanitarian domains; they have emerged as systemic threats to global financial stability.

Physical risks from extreme weather events damage infrastructure and disrupt economic activities, leading to reduced productivity and asset devaluation. For instance, hurricanes and floods can wipe out physical assets, reducing collateral for loans and increasing default rates in the banking sector. Moreover, prolonged droughts can severely affect agricultural yields, diminishing the repayment capacity of farmers and agri-based enterprises. Heatwaves and wildfires also pose significant threats to manufacturing and energy infrastructure, resulting in operational shutdowns and insurance losses. In coastal regions, rising sea levels can erode land values and displace communities, weakening local credit markets. Collectively, these climate-induced shocks not only strain financial institutions' balance sheets but also ripple through broader economic systems, heightening systemic risk and market volatility.

The transition risks, on the other hand, stem from shifts in policy, technology, and consumer preferences. The implementation of carbon-pricing, stricter emission standards, and growing adoption of renewable energy technologies may lead to significant repricing of high-carbon assets, creating financial instability for institutions heavily invested in fossil fuel sectors. Both types of risks demand proactive strategies from regulatory bodies and financial institutions to ensure

market stability. Additionally, sudden regulatory changes can render existing business models obsolete, forcing rapid asset write-downs and capital reallocation. Investor sentiment is increasingly influenced by ESG considerations, which can amplify market volatility for non-compliant firms. Furthermore, companies that fail to innovate or transition to low-carbon alternatives risk reputational damage, reduced access to financing, and heightened credit risk exposure.



Source: Federal Reserve Bank of San Francisco

Policy frameworks and disclosure mechanisms

Global financial governance has evolved to recognize the materiality of climate-related risks. Frameworks such as the TCFD (2017) ^[13] have laid the foundation for standardized disclosure practices, promoting transparency in climate-related financial reporting. The EU Sustainable Finance Taxonomy and Paris Agreement have further guided institutions toward integrating environmental considerations into financial decision-making.

In many jurisdictions, regulators are mandating climate stress testing, scenario analysis, and risk disclosure to ensure that markets can internalize climate costs. For instance, the Bank of England, European Central Bank, and NGFS advocate that central banks incorporate climate risk into prudential supervision (Bolton *et al.*, 2020) ^[3].

Nevertheless, the enforcement of these policies remains inconsistent across countries. Several studies (Chua, 2022; Auzepy *et al.*, 2023) ^[5, 1] highlight disparities in disclosure quality and the lack of harmonization in reporting standards. There is also a need to align national regulatory practices with global frameworks to prevent greenwashing and ensure credibility in ESG investments.

Enhanced disclosure mechanisms not only improve investor confidence but also enable financial institutions to allocate capital more efficiently toward sustainable assets. In doing so, they contribute to long-term economic resilience and climate adaptation.

Strategic directions for future research and policy innovation

To mitigate the systemic impacts of climate risks, both policymakers and financial institutions must pursue coordinated strategies emphasizing innovation, transparency, and inclusivity. Future research and policy efforts should focus on the following directions:

- **Developing robust climate risk assessment tools:** Financial institutions must incorporate both physical and transition risks into their risk modeling frameworks. Climate-adjusted credit scoring and stress testing can help in pricing climate exposure accurately.
- **Strengthening mandatory disclosures:** Regulatory bodies should ensure compliance with global disclosure standards such as TCFD, making climate risk reporting mandatory for major corporations and financial intermediaries.
- **Creating incentives for green investments:** Governments can provide tax benefits, subsidies, and guarantees for renewable energy projects and sustainable financial instruments such as green bonds.
- **Encouraging public-private partnerships:** Collaborative models involving government, private investors, and multilateral institutions can enhance climate resilience and finance adaptation infrastructure.
- **Promoting academic-policy integration:** Future studies should empirically test the effectiveness of regulatory measures and examine cross-sectoral linkages of climate risks, helping bridge the gap between theory and implementation.

This conceptual study contributes to both policy and academia by laying the groundwork for developing a unified framework that views climate risks as systemic financial threats requiring collective global action.

Conclusion

Climate change has emerged as a defining challenge of the 21st century, carrying profound implications for global financial stability. The intersection of environmental and financial risks underscores the urgency of integrating climate considerations into mainstream financial governance. By synthesizing literature and policy evidence, this study reveals that climate risks—whether physical or transition-related—pose systemic threats to banking, insurance, energy, and real estate sectors. Effective risk assessment tools, strong disclosure mechanisms, and coordinated international policies are essential to safeguard financial markets.

A collaborative global approach is needed to ensure that financial systems not only survive but evolve to support sustainable growth amid rising climate uncertainties. Aligning finance with sustainability is not merely a moral imperative—it is an economic necessity for future resilience.

References

1. Auzepy A, Tönjes E, Lenz D, Funk C. Evaluating TCFD reporting: A new application of zero-shot analysis to

- climate-related financial disclosures. arXiv, 2023. <https://doi.org/10.48550/arXiv.2302.00326>
2. Battiston S, Mandel A, Monasterolo I, Schütze F. A climate stress-test of the financial system. *Nature Climate Change*. 2017;7(4):283–88. <https://doi.org/10.1038/nclimate3255>
3. Bolton P, Després M, Pereira da Silva LA, Samama F, Svartzman R. *The green swan: Central banking and financial stability in the age of climate change*. Bank for International Settlements and Banque de France, 2020.
4. Carney M. Breaking the tragedy of the horizon—Climate change and financial stability. Speech at Lloyd's of London, 2015.
5. Chua WF. Task Force on Climate-Related Financial Disclosures: Sustainability reporting policy and global regulatory response in Australia. *Aust Account Rev*, 2022. <https://doi.org/10.1111/auar.12388>
6. Dietz S, Bowen A, Dixon C, Gradwell P. Climate value at risk of global financial assets. *Nature Climate Change*. 2016;6:676–79.
7. Intergovernmental Panel on Climate Change (IPCC). *Climate change 2022: Mitigation of climate change*. Cambridge University Press, 2022. <https://doi.org/10.1017/9781009157926>
8. Intergovernmental Panel on Climate Change (IPCC). *Climate change 2023: Synthesis report*. IPCC, 2023. <https://doi.org/10.59327/IPCC/AR6-9789291691647>
9. Keenan JM, Hill T, Gumber A. Climate gentrification: From theory to empiricism in Miami-Dade County, Florida. *Environ Res Lett*. 2018;13(5):054001.
10. Monasterolo I, Raberto M. The EIRIN macro-financial model: Modeling systemic climate-related financial risks. *J Artif Soc Soc Simul*. 2019;22(2):4.
11. Network for Greening the Financial System (NGFS). *A call for action: Climate change as a source of financial risk*. NGFS, 2019.
12. Poortvliet PM. A content analysis of IPCC's Summary for Policymakers: Effectiveness in risk communication. *Sustainability*. 2020;12(12):4861. <https://doi.org/10.3390/su12124861>
13. Task Force on Climate-Related Financial Disclosures (TCFD). *Recommendations of the Task Force on Climate-Related Financial Disclosures*. Financial Stability Board, 2017.
14. Thomson I. Engaging with the IPCC on climate finance: A call to environmental accountants. *Account Forum*, 2022. <https://doi.org/10.1080/0969160X.2022.2085131>
15. World Economic Forum. *The future of financial infrastructure: An ambitious look at how blockchain can reshape financial services*. White Paper, 2020.
16. Maslin MA, Lang J, Harvey F. A short history of the successes and failures of the international climate change negotiations. *UCL Open Environ*, 2023;5. <https://doi.org/10.14324/111.444/ucloe.000059>.