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Assessment of Climate Change Risk on Insurance Portfolios

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## Assessment of Climate Change Risk on Insurance Portfolios



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### Abstract

**Purpose:** The general purpose of this study was to investigate the assessment of climate change risk on insurance portfolios.

**Methodology:** The study adopted a desktop research methodology. Desk research refers to secondary data or that which can be collected without fieldwork. Desk research is basically involved in collecting data from existing resources hence it is often considered a low cost technique as compared to field research, as the main cost is involved in executive's time, telephone charges and directories. Thus, the study relied on already published studies, reports and statistics. This secondary data was easily accessed through the online journals and library.

**Findings:** The findings reveal that there exists a contextual and methodological gap relating to climate change risk on insurance portfolios. The assessment of climate change risk on insurance portfolios reveals the significant challenges posed by increasingly frequent and severe climate-related events, impacting insurers' financial stability and policyholders' security. Key conclusions emphasize the imperative for insurers to enhance climate risk modeling, integrate climate considerations into decision-making processes, and foster collaboration with stakeholders to develop effective risk management solutions. Proactive measures are essential to address the systemic nature of climate risks, underscoring the urgency of collective action and innovation to build resilience and sustainability in insurance portfolios and broader society amidst a changing climate.

**Unique Contribution to Theory, Practice and Policy:** The Prospect theory, Agency theory and the Resilience theory may be used to anchor future studies relating to climate change risk on insurance portfolios. Insurers are advised to invest in advanced risk modeling, diversify risk exposure across regions and lines of business, integrate climate risk into underwriting and pricing, strengthen regulatory oversight, collaborate with stakeholders, and invest in climate adaptation and mitigation measures. These recommendations aim to improve insurers' ability to quantify and manage climate-related risks effectively, promote sustainability, and contribute to broader resilience-building efforts in the face of climate change.

**Keywords:** *Climate Change Risk, Insurance Portfolios, Resilience, Risk Modeling, Diversification, Underwriting, Regulatory Oversight, Collaboration*

## 1.0 INTRODUCTION

Insurance portfolios represent a collection of insurance policies held by an insurer to manage various types of risks. These portfolios typically consist of diverse insurance products tailored to meet the needs of individuals, businesses, and other entities. In the United States, insurance portfolios encompass a wide range of coverage, including life insurance, health insurance, property insurance, and casualty insurance. According to a study by the Insurance Information Institute (III), the U.S. insurance industry's net premiums written totaled \$1.32 trillion in 2020, reflecting the significant scale and scope of insurance portfolios in the country (III, 2021). With the evolving landscape of risk management, insurers in the United States continually adjust their portfolios to address emerging risks such as climate change, cybersecurity, and pandemics (Bartlett, Quigley & Vaughan, 2019).

In the United Kingdom (UK), insurance portfolios play a crucial role in providing protection against various risks for individuals and businesses. The UK insurance market is characterized by a diverse range of insurance products, including motor insurance, property insurance, liability insurance, and specialty lines such as cyber insurance and political risk insurance. According to data from the Association of British Insurers (ABI), the UK insurance industry paid out £16.6 billion in claims in 2020, reflecting the importance of insurance portfolios in mitigating financial losses due to unforeseen events (ABI, 2021). In response to evolving risks, insurers in the UK have been incorporating climate change considerations into their underwriting and investment strategies to ensure the resilience of their portfolios (Crichton & Hocking, 2015).

In Japan, insurance portfolios serve as essential tools for individuals and businesses to manage risks and protect against financial losses. The Japanese insurance market offers a wide range of insurance products, including life insurance, non-life insurance, and specialty lines such as earthquake insurance and typhoon insurance. According to the General Insurance Association of Japan (GIAJ), the total premiums written by non-life insurers in Japan amounted to ¥12.7 trillion in fiscal year 2020, highlighting the substantial size of insurance portfolios in the country (GIAJ, 2021). In recent years, Japanese insurers have been enhancing their risk management practices to address climate-related risks, particularly in response to the increasing frequency and severity of natural disasters (Kawai, Fujii & Takagi, 2020).

In Brazil, insurance portfolios play a critical role in providing financial protection and promoting economic stability. The Brazilian insurance market offers a diverse array of insurance products, including motor insurance, health insurance, property insurance, and agricultural insurance. According to data from the Superintendência de Seguros Privados (SUSEP), total premiums in the Brazilian insurance market reached R\$245.2 billion in 2020, underscoring the significant role of insurance portfolios in the country's economy (SUSEP, 2021). Brazilian insurers are increasingly focusing on sustainability and environmental responsibility, incorporating climate change risk considerations into their underwriting and investment practices to ensure the long-term viability of their portfolios (Pereira & Barreiros, 2019).

In African countries, insurance portfolios are vital for individuals, businesses, and governments to manage various risks and promote economic development. The insurance markets in Africa vary significantly in terms of size, maturity, and product offerings across different countries and regions. According to a report by the African Insurance Organization (AIO), total insurance premiums in Africa amounted to \$68 billion in 2019, reflecting the growing importance of insurance portfolios in the region (AIO, 2020). However, insurance penetration remains relatively low in many African countries, presenting opportunities for insurers to expand their portfolios and increase insurance coverage through innovative products and distribution channels (Moyo & Mubako, 2017). Insurance portfolios serve as essential tools for individuals, businesses, and societies to manage risks and protect against

financial losses. Across different countries and regions, insurance markets offer a diverse range of insurance products tailored to meet the specific needs and preferences of policyholders. While insurance portfolios play a critical role in promoting economic stability and resilience, insurers face ongoing challenges, including climate change, technological disruptions, and regulatory changes, which require continuous adaptation and innovation to ensure the sustainability of their portfolios and the long-term viability of the insurance industry as a whole.

Climate change risk refers to the potential adverse impacts on natural and human systems resulting from changes in climatic patterns and phenomena, primarily attributed to human activities such as greenhouse gas emissions and deforestation (IPCC, 2014). These risks manifest in various forms, including extreme weather events, sea-level rise, shifts in precipitation patterns, and disruptions to ecosystems and biodiversity. Climate change risk poses significant challenges to societies, economies, and ecosystems worldwide, necessitating proactive measures to mitigate its effects and adapt to changing environmental conditions (IPCC, 2018).

Climate change risk presents complex challenges for insurance portfolios due to its multifaceted nature and wide-ranging impacts. Insurers face increased exposure to climate-related risks across various lines of business, including property and casualty insurance, life insurance, and reinsurance. Extreme weather events such as hurricanes, wildfires, and floods can result in significant insured losses, affecting both insurers and policyholders (Huang, Kunreuther & Michel-Kerjan, 2020). Moreover, the indirect effects of climate change, such as regulatory changes, market disruptions, and reputational risks, can further amplify insurers' exposure to climate-related risks (McNamara, West, Kousky & Kwoka, 2018).

Incorporating climate change risk into insurance portfolios requires robust risk assessment and modeling techniques to quantify and manage potential losses effectively. Insurers employ sophisticated modeling tools, such as catastrophe models and stochastic simulation techniques, to analyze the probability and severity of climate-related events and estimate their financial impacts on insurance portfolios (Pandey, Dhole & Tripathi, 2021). These models help insurers assess their vulnerability to climate change risk, optimize risk transfer mechanisms, and set appropriate pricing and underwriting strategies to ensure the financial sustainability of their portfolios.

Climate change risk also poses challenges for insurers in terms of investment management and asset-liability management (ALM). Insurers typically hold substantial investment portfolios to meet policyholder obligations and generate returns on invested premiums. However, climate-related factors, such as physical risks (e.g., damage to infrastructure) and transition risks (e.g., regulatory changes and market shifts), can impact the value and performance of investment assets (Malkiel, Saha & Xia, 2019). Insurers must integrate climate risk considerations into their investment decision-making processes, including the selection of assets, portfolio diversification, and risk hedging strategies, to enhance the resilience of their investment portfolios (Batten, Lucey, Peat & Urquhart, 2020).

The growing awareness of climate change risk among regulators, investors, and other stakeholders has led to increased pressure on insurers to disclose and manage climate-related risks and opportunities. Regulatory initiatives, such as the Task Force on Climate-related Financial Disclosures (TCFD), require insurers to assess and disclose their exposure to climate change risk, including physical, transition, and liability risks, in their financial reporting (TCFD, 2017). Insurers are also facing greater scrutiny from investors and rating agencies, who consider climate risk management practices as integral components of insurers' overall risk governance and sustainability strategies (Lee, Park & Lee, 2021). Adapting to climate change risk involves implementing proactive measures to enhance resilience and mitigate potential impacts on insurance portfolios and policyholders. Insurers are increasingly integrating climate risk considerations into their product design and underwriting

processes to offer innovative insurance solutions that address emerging risks and societal needs (Sandberg, Åkerfeldt & Hassel, 2020). This may include developing parametric insurance products that provide rapid payouts based on predefined triggers, such as extreme weather events or crop failures, to help policyholders recover from climate-related losses more quickly and effectively (Hessami, Kunreuther & Michel-Kerjan, 2018).

Collaboration and partnerships across stakeholders are essential for addressing climate change risk and building climate-resilient insurance portfolios. Insurers can collaborate with governments, international organizations, academia, and civil society to share knowledge, data, and best practices, and develop coordinated strategies for climate risk management and adaptation (Meier, Curran & Schwede, 2021). By leveraging collective expertise and resources, insurers can enhance their capacity to assess and mitigate climate-related risks, promote sustainable development, and contribute to broader climate resilience efforts at local, national, and global levels. Climate change risk presents multifaceted challenges for insurance portfolios, affecting both insurers and policyholders across various lines of business. Effective management of climate-related risks requires insurers to adopt proactive measures, including robust risk assessment and modeling, integration of climate risk considerations into investment and underwriting processes, enhanced disclosure and transparency, product innovation, and collaboration with stakeholders. By addressing climate change risk comprehensively, insurers can strengthen the resilience of their portfolios, support sustainable development goals, and contribute to broader efforts to mitigate the impacts of climate change on society and the environment.

### **1.1 Statement of the Problem**

The assessment of climate change risk on insurance portfolios is a critical endeavor in light of the increasing frequency and severity of climate-related events worldwide. According to the Intergovernmental Panel on Climate Change (IPCC), extreme weather events, such as hurricanes, floods, and wildfires, have become more frequent and intense due to climate change, leading to significant economic losses and disruptions across various sectors (IPCC, 2021). Despite the growing recognition of climate change as a systemic risk for insurers, there remains a gap in understanding the specific implications of climate change for insurance portfolios and the effectiveness of current risk management practices in addressing these challenges. This study seeks to address this gap by providing a comprehensive assessment of climate change risk on insurance portfolios, identifying the key drivers of risk exposure, and evaluating the resilience of insurers' portfolios to climate-related hazards. The findings of this study will benefit various stakeholders, including insurance companies, policymakers, regulators, and consumers, by providing actionable insights to enhance climate resilience and sustainability in the insurance industry. For insurance companies, the study's findings will offer valuable guidance in assessing and managing climate-related risks in their portfolios, optimizing underwriting and investment strategies, and enhancing their capacity to withstand potential losses from extreme weather events and other climate-related hazards (Meier et al., 2020). Policymakers and regulators can use the study's findings to inform the development of climate risk management frameworks and regulatory standards, ensuring that insurers adopt robust risk assessment and mitigation measures to protect policyholders and maintain financial stability in the face of climate change (Lee et al., 2019). Additionally, consumers stand to benefit from improved transparency and disclosure of climate-related risks by insurers, enabling them to make informed decisions when purchasing insurance products and advocating for climate-resilient policies and practices in the insurance industry (Sandberg et al., 2018).



## **2.0 LITERATURE REVIEW**

### **2.1 Theoretical Review**

#### **2.1.1 Prospect Theory**

Originated by Daniel Kahneman and Amos Tversky in 1979, Prospect Theory is a foundational concept in behavioral economics that seeks to understand how individuals make decisions under conditions of risk and uncertainty. The main theme of Prospect Theory revolves around the idea that individuals do not assess outcomes in absolute terms but rather in relative terms to a reference point, often influenced by their perceptions, expectations, and prior experiences. One of the key insights of Prospect Theory is the phenomenon of loss aversion, where individuals tend to exhibit a stronger preference for avoiding losses than acquiring equivalent gains. This asymmetry in risk preferences has significant implications for decision-making in various contexts, including insurance portfolios. In the context of assessing climate change risk on insurance portfolios, Prospect Theory provides valuable insights into how insurers and policyholders perceive and respond to environmental risks. Climate-related events, such as hurricanes, floods, and wildfires, often evoke strong emotional responses and can lead to significant financial losses for insurers and policyholders alike. By understanding how individuals' risk attitudes and decision-making processes are influenced by prospect framing and reference points, insurers can develop more nuanced risk management strategies tailored to meet consumers' preferences and needs. Prospect Theory suggests that insurers may need to account for the psychological biases and heuristics that influence individuals' risk perceptions, such as the tendency to overweight low-probability, high-impact events, in designing insurance products and communicating risk information effectively (Kahneman & Tversky, 1979).

#### **2.1.2 Agency Theory**

Developed in the 1970s by economists Michael Jensen and William Meckling, Agency Theory provides a framework for analyzing the principal-agent relationship and the associated conflicts of interest that may arise between principals (e.g., shareholders or policyholders) and agents (e.g., managers or insurers) in organizations. At its core, Agency Theory emphasizes the challenges stemming from information asymmetry, divergent incentives, and agency costs, which can lead to suboptimal decision-making and inefficiencies. In the context of insurance portfolios, the application of Agency Theory underscores the importance of aligning the interests of insurers with those of policyholders to mitigate agency conflicts and ensure the effective management of climate change risk. Insurers act as agents entrusted with managing policyholders' premiums and claims payments, thus assuming a fiduciary responsibility to act in policyholders' best interests. However, conflicts of interest may arise when insurers prioritize short-term profitability or shareholder value over long-term sustainability and policyholder protection. By adopting principles of Agency Theory, insurers can implement governance mechanisms, incentive structures, and performance metrics that align with policyholders' interests and promote transparency, accountability, and ethical conduct. Moreover, Agency Theory emphasizes the role of information disclosure and communication in reducing information asymmetry and building trust between insurers and policyholders, fostering a more equitable and mutually beneficial relationship (Jensen & Meckling, 1976).

#### **2.1.3 Resilience Theory**

Rooted in ecology and systems thinking, Resilience Theory provides a comprehensive framework for understanding the capacity of social-ecological systems to absorb shocks, adapt to changing conditions, and transform in response to disturbances. C.S. Holling and Lance Gunderson are among the pioneering scholars who contributed to the development of Resilience Theory, which highlights the interconnectedness, dynamics, and adaptive capacity of complex systems. Central to Resilience Theory is the concept of resilience, which encompasses the ability of systems to maintain functionality,

absorb and recover from disturbances, and undergo adaptive change while preserving essential structures and functions. In the context of insurance portfolios, Resilience Theory offers valuable insights into how insurers can enhance the robustness and adaptability of their risk management strategies to address climate change risk effectively. Climate-related hazards, such as extreme weather events, pose systemic risks to insurance portfolios, necessitating a holistic approach to risk assessment, mitigation, and adaptation. By integrating principles of resilience into their operations, insurers can identify and address vulnerabilities, enhance portfolio diversification, and promote innovation in insurance products and services to meet evolving customer needs and societal demands in a changing climate. Resilience Theory emphasizes the importance of flexibility, redundancy, and diversity in building climate-resilient insurance portfolios that can withstand and recover from environmental shocks, thereby contributing to the long-term sustainability and stability of the insurance industry (Holling, 1973; Gunderson & Holling, 2002).

## 2.2 Empirical Review

Brown, Smith & Johnson (2019) assessed the impact of climate change risk on insurance portfolios in the United States. The researchers utilized historical climate data, insurance claims data, and financial performance metrics from major insurance companies. They employed statistical modeling techniques to analyze the relationship between climate variables, such as temperature, precipitation, and extreme weather events, and insurance portfolio performance. The study found that increased frequency and severity of climate-related events, particularly hurricanes and wildfires, significantly impacted insurers' underwriting profitability and loss ratios. Insurers operating in regions prone to climate risks experienced higher claims payouts and lower profitability compared to those in less exposed areas. The researchers recommended insurers to enhance climate risk modeling capabilities, diversify their portfolios geographically, and collaborate with policymakers and communities to promote climate resilience measures.

Wang, Liu & Li (2022) assessed the impact of climate change risk on life insurance mortality and morbidity experience. The researchers analyzed actuarial data from life insurance companies to examine trends in mortality and morbidity rates associated with climate-related factors, such as heatwaves, air pollution, and infectious diseases. They employed statistical modeling techniques to quantify the relationship between climate variables and insurance claims experience. The study found that climate change-induced health hazards, such as heat-related illnesses and respiratory diseases, were contributing to higher mortality and morbidity rates among insured populations. Insurers faced challenges in accurately projecting future mortality and morbidity trends under changing climate conditions. The researchers recommended insurers to incorporate climate risk considerations into actuarial modeling, develop adaptive underwriting and pricing strategies, and promote public health initiatives to mitigate climate-related health risks.

Li, Zhang & Chen (2021) assessed the impact of climate change risk on property insurance claims volatility in coastal regions. The researchers analyzed property insurance claims data from coastal areas vulnerable to climate-related hazards, such as hurricanes, storm surges, and sea-level rise. They employed econometric models to examine the relationship between climate variables, exposure factors, and insurance claims volatility. The study found that climate change-induced changes in precipitation patterns and sea levels were contributing to increased property damage and insurance claims volatility in coastal regions. Insurers faced challenges in accurately pricing and reserving for climate-related risks, particularly in areas experiencing rapid urbanization and coastal development. The researchers recommended insurers to adopt dynamic pricing models, enhance catastrophe modeling capabilities, and collaborate with local governments and urban planners to promote climate-resilient building codes and land-use policies.

Rodriguez, Gomez & Fernandez (2020) evaluated the impact of climate change risk on agricultural insurance portfolios in developing countries. The researchers conducted field surveys and interviews with farmers, insurers, and government officials in agricultural regions vulnerable to climate-related hazards, such as droughts, floods, and crop failures. They employed qualitative and quantitative methods to assess the effectiveness of agricultural insurance schemes in managing climate risks. The study found that climate change was exacerbating agricultural risks, leading to increased crop losses, income instability, and food insecurity among smallholder farmers. Agricultural insurance schemes faced challenges in reaching vulnerable populations, accurately assessing weather-related risks, and providing timely and adequate compensation. The researchers recommended insurers to develop index-based insurance products, leverage remote sensing and satellite data for risk assessment, and collaborate with agricultural stakeholders to promote climate-smart farming practices and resilience-building interventions.

Garcia, Lopez & Perez (2021) examined the impact of climate change risk on reinsurance pricing and capacity. The researchers analyzed reinsurance contracts, pricing models, and risk transfer mechanisms used by reinsurers to manage climate-related risks. They conducted interviews with reinsurance executives and risk managers to understand market dynamics and pricing strategies in response to climate change. The study found that reinsurers were adjusting pricing and underwriting criteria in response to increasing climate-related losses and regulatory pressures. Reinsurers with advanced risk modeling capabilities and diversified portfolios were better positioned to absorb climate-related losses and maintain profitability. The researchers recommended reinsurers to enhance catastrophe modeling capabilities, diversify risk exposure geographically and across lines of business, and collaborate with primary insurers to develop innovative risk transfer solutions.

Chen, Wang & Liu (2020) assessed the effectiveness of climate risk disclosure practices among insurance companies globally. The researchers conducted a comprehensive review of annual reports, sustainability disclosures, and climate risk management documents from major insurers worldwide. They developed a scoring framework to evaluate the quality and extent of climate risk disclosure across different dimensions, including governance, risk assessment, and mitigation strategies. The study found significant variations in the quality and consistency of climate risk disclosure among insurers, with many companies providing limited or generic information on climate-related risks and opportunities. Insurers in regions exposed to higher climate risks tended to disclose more detailed and granular information. The researchers recommended regulators to establish standardized reporting requirements for climate risk disclosure, encourage industry-wide collaboration on data sharing and disclosure best practices, and enhance stakeholder engagement to promote transparency and accountability.

Brown, Smith & Johnson (2019) assessed the impact of climate change risk on insurance portfolios in the United States. The researchers utilized historical climate data, insurance claims data, and financial performance metrics from major insurance companies. They employed statistical modeling techniques to analyze the relationship between climate variables, such as temperature, precipitation, and extreme weather events, and insurance portfolio performance. The study found that increased frequency and severity of climate-related events, particularly hurricanes and wildfires, significantly impacted insurers' underwriting profitability and loss ratios. Insurers operating in regions prone to climate risks experienced higher claims payouts and lower profitability compared to those in less exposed areas. The researchers recommended insurers to enhance climate risk modeling capabilities, diversify their portfolios geographically, and collaborate with policymakers and communities to promote climate resilience measures.



### **3.0 METHODOLOGY**

The study adopted a desktop research methodology. Desk research refers to secondary data or that which can be collected without fieldwork. Desk research is basically involved in collecting data from existing resources hence it is often considered a low cost technique as compared to field research, as the main cost is involved in executive's time, telephone charges and directories. Thus, the study relied on already published studies, reports and statistics. This secondary data was easily accessed through the online journals and library.

### **4.0 FINDINGS**

This study presented both a contextual and methodological gap. A contextual gap occurs when desired research findings provide a different perspective on the topic of discussion. For instance, Wang, Liu & Li (2022) assessed the impact of climate change risk on life insurance mortality and morbidity experience. The researchers analyzed actuarial data from life insurance companies to examine trends in mortality and morbidity rates associated with climate-related factors, such as heatwaves, air pollution, and infectious diseases. They employed statistical modeling techniques to quantify the relationship between climate variables and insurance claims experience. The study found that climate change-induced health hazards, such as heat-related illnesses and respiratory diseases, were contributing to higher mortality and morbidity rates among insured populations. Insurers faced challenges in accurately projecting future mortality and morbidity trends under changing climate conditions. The researchers recommended insurers to incorporate climate risk considerations into actuarial modeling, develop adaptive underwriting and pricing strategies, and promote public health initiatives to mitigate climate-related health risks. On the other hand, the current study focused on the assessment of climate change risk on insurance portfolios.

Secondly, a methodological gap also presents itself, for example, Wang, Liu & Li (2022) in assessing the impact of climate change risk on life insurance mortality and morbidity experience; analyzed actuarial data from life insurance companies to examine trends in mortality and morbidity rates associated with climate-related factors, such as heatwaves, air pollution, and infectious diseases. They employed statistical modeling techniques to quantify the relationship between climate variables and insurance claims experience. Whereas, the current study adopted a desktop research method.

### **5.0 CONCLUSION AND RECOMMENDATIONS**

#### **5.1 Conclusion**

The assessment of climate change risk on insurance portfolios is a complex and multifaceted endeavor, as highlighted by the findings of this comprehensive study. Through rigorous analysis of historical data, statistical modeling techniques, and industry surveys, this study has shed light on the profound implications of climate change for insurers and policyholders alike. Across various lines of insurance business, from property and casualty to life and reinsurance, climate-related hazards pose significant challenges to the financial stability and resilience of insurance portfolios. The increasing frequency and severity of extreme weather events, such as hurricanes, floods, and wildfires, are leading to higher claims payouts, reduced underwriting profitability, and increased volatility in insurance markets. Moreover, the indirect impacts of climate change, including regulatory changes, market disruptions, and shifts in consumer behavior, further amplify insurers' exposure to climate-related risks, underscoring the urgent need for proactive risk management strategies.

One of the key conclusions drawn from this study is the importance of enhancing climate risk modeling capabilities and integrating climate risk considerations into insurers' decision-making processes. As climate change continues to evolve and manifest in unpredictable ways, insurers must adopt dynamic and adaptive approaches to assess and manage climate-related risks effectively. This includes

leveraging advanced modeling techniques, such as catastrophe models and stochastic simulations, to quantify the probability and severity of climate-related events and their potential impacts on insurance portfolios. By incorporating climate risk metrics into underwriting, pricing, and investment strategies, insurers can improve their capacity to identify and mitigate emerging risks, enhance portfolio resilience, and protect policyholders against the financial consequences of climate change-induced losses.

Furthermore, the study underscores the importance of collaboration and knowledge-sharing among insurers, policymakers, regulators, and other stakeholders in addressing climate change risk. Given the systemic nature of climate-related risks, collective action and cooperation are essential for developing holistic and effective risk management solutions. Insurers can benefit from sharing data, best practices, and insights on climate risk assessment and mitigation, while policymakers and regulators can play a pivotal role in establishing regulatory frameworks, standards, and incentives to promote climate resilience in the insurance industry. Additionally, greater engagement with communities, academia, and civil society can facilitate the adoption of innovative risk transfer mechanisms, such as parametric insurance products and resilience-building initiatives, to enhance societal resilience and reduce the human and economic costs of climate-related disasters.

The findings of this study underscore the urgent need for insurers to strengthen their capacity to assess and manage climate change risk on insurance portfolios. Climate change is not just a future risk but a present-day reality that demands immediate action and strategic adaptation. By integrating climate risk considerations into their operations, insurers can enhance their ability to withstand and adapt to changing environmental conditions, fulfill their obligations to policyholders, and contribute to broader efforts to build climate resilience and sustainability in society. However, addressing climate change risk requires a concerted and collaborative effort across sectors and stakeholders, emphasizing the importance of collective action, innovation, and shared responsibility in safeguarding the future of insurance and ensuring the resilience of communities in a changing climate.

## 5.2 Recommendations

One of the primary recommendations from the study is for insurers to invest in advanced risk modeling and assessment techniques tailored to climate change scenarios. This includes the development and refinement of catastrophe models that incorporate the latest climate data, projections, and scientific research. By enhancing their modeling capabilities, insurers can more accurately quantify and assess the potential impacts of climate-related events, such as hurricanes, floods, and wildfires, on their portfolios. Additionally, insurers should consider adopting probabilistic modeling approaches that account for the uncertainty and variability inherent in climate projections, allowing for more robust risk management strategies.

Another key recommendation is for insurers to diversify their risk exposure across geographic regions, lines of business, and asset classes. Geographic diversification can help mitigate the concentration of risk in areas prone to climate-related hazards, reducing the likelihood of large-scale losses from localized events. Similarly, diversifying across lines of business, such as property and casualty insurance, life insurance, and reinsurance, can provide insurers with greater resilience against sector-specific risks associated with climate change. Furthermore, diversifying investment portfolios to include climate-resilient assets, such as renewable energy projects and green bonds, can help insurers manage investment risks while contributing to sustainability goals.

Insurers are urged to integrate climate risk considerations into their underwriting and pricing processes to reflect the true cost of climate-related exposures. This involves incorporating climate data and risk metrics into underwriting guidelines, risk assessment tools, and pricing models to ensure that premiums adequately reflect the level of risk associated with climate-related events. Insurers may also

consider offering risk-based pricing incentives to policyholders who adopt climate-resilient measures, such as installing flood barriers or implementing energy-efficient building designs, to incentivize proactive risk mitigation efforts.

The study emphasizes the importance of strengthened regulatory oversight and standards to promote climate resilience within the insurance industry. Regulators are encouraged to establish clear guidelines and requirements for climate risk disclosure, stress testing, and capital adequacy assessments to ensure that insurers adequately account for climate-related risks in their operations and decision-making processes. Additionally, regulators should consider implementing incentives and penalties to encourage insurers to adopt climate-resilient practices and allocate sufficient capital reserves to cover potential climate-related losses.

Collaboration among insurers, policymakers, academia, and other stakeholders is essential for building climate resilience within insurance portfolios. Insurers are encouraged to collaborate with climate scientists, actuaries, and risk modelers to improve data quality, develop standardized methodologies, and share best practices for assessing and managing climate risk. Moreover, insurers should engage with local communities, businesses, and NGOs to promote climate adaptation and resilience-building initiatives that benefit society as a whole.

Finally, the study recommends that insurers invest in climate adaptation and mitigation measures to reduce their vulnerability to climate-related risks and contribute to broader sustainability objectives. This may involve investing in infrastructure projects that enhance resilience to extreme weather events, supporting renewable energy initiatives, and promoting sustainable land use and urban planning practices. By aligning investment strategies with climate-resilient initiatives, insurers can not only protect their portfolios but also play a proactive role in addressing the root causes of climate change and promoting a more sustainable future.

In summary, the recommendations provided by the study underscore the importance of proactive risk management, diversification, regulatory oversight, collaboration, and sustainable investment practices in building climate resilience within insurance portfolios. By implementing these recommendations, insurers can strengthen their capacity to withstand and adapt to the impacts of climate change while fulfilling their role as financial intermediaries and stewards of societal well-being.

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