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Extreme Weather Patterns and Risk Assessment Strategies in the Banking Industry: A Survey

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Abstract:

Purpose: *The scope of the paper is to assess the current methodology regarding weather related risk management, as well as, changes in the risk management methodology considered by Bank Executives.*
Methodology: *Over 150 Bank executives of banks in the Second Federal Reserve District were invited to response to a survey regarding extreme weather risk related adjustments in their organization at the operational level, the asset allocation level and the organizational with respect to risk identification and management, scenario analysis implementation and transparency.*
Findings: *There is some movement by bank executives to assess, manage and report the risk exposure of large financial institutions to extreme weather events, but more in depth consideration should be undertaken in the following key areas identification, monitor, and management.*
Practical Implications: *Climate change affects a large number of weather sensitive sectors including energy, transportation, agriculture, infrastructure, ecosystems and specific industries within these sectors especially financial services providers.*
Originality valua: *The study recommends an in depth assessment of the impact of extreme weather related issues on the performance and the stability of financial intermediaries.*

Keywords: *Financial institutions, financial markets, financial services, risk, extreme weather.*

JEL Classification: *G17, G21.*

Paper type: *Research article.*

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1. Introduction

The recent hurricane that hit the US East Coast, US West Coast wild fires, the intense heat in the US South and other catastrophic events are having profound and lasting economic and financial effects for the USA economy.

Extreme weather conditions also affect water supply, air quality and health. The resulting higher costs, medical expenses and lost productivity are all contributing factors to higher inflation and the CPI. A distinction should be made between vulnerability to weather conditions and shocks to the economic and financial system resulting from weather conditions.

Many of the items and sectors named above are interconnected and they impact broad segments on the economy such as infrastructure of urban and suburban areas, property values and put pressure on municipal and state budgets. Given the extend of the impact it is important to develop capacity to assess the risks and the financial implications.

The scope of the paper is to address risk management and discuss how the development of new risks associated with climate change is beginning to change the practice of risk management at both, non-financial and financial institutions in terms of governance, risk identification and management, scenario analysis and transparency. Emphasis will be given to the banking sector and steps to modelling will be provided at the end.

2. Climate Change and Risk Management

The discussion of climate change and risk management has introduced to the literature new terminology for discussions on risk to complement and to supplement the traditional market, credit, operational, legal and reputational risk; the new terms are physical risk and transition risk

Physical risk is the potential for losses as climate-related changes destroy property and homes, disrupt business operations, destroy infrastructure capital and interrupt economic activity and the daily. *Transition risk* is the potential for loss resulting from a shift toward a lower-carbon green economy as policy, consumer sentiment and technological innovations impact the value of certain assets and liabilities.

These effects are felt across business sectors and asset classes, on strategies and operations, and through the balance sheets and income statements of both production related firms and their financial counter parts. It is easy to detect the connectivity between for example, the home construction industry, the energy industry and the housing mortgage market. In addition these interconnections affect both investment allocations and mutual funds as financial advisors and mutual managers incorporate these new types of risk in their decision making process.

At a practical level, production managers are employing Enterprise Resource Management systems to minimize expected losses, shift to greener techniques and greener products by paying closer attention to their carbon foot print and are devising strategies to control financial recovery.

Risk managers at financial institutions are beginning to develop the appropriate tools to identify, monitor and manage these risks, as there is a noticeable and profound connection between insurance and finance. Weather derivatives, weather future options and insurance contracts are new hedging tools.

From one perspective, the argument could be made that climate-related risks manifest as realizations of the traditional types of risk familiar risks . The counter argument would be that the tools risk managers use, should change to reflect new data, changing relationships, and evolving interconnections, and that backward-looking models based on historical trends are no longer reliable.

It should be pointed out that there is a difference between insurance contracts which address rarely occurring weather events with high catastrophic outcomes and weather derivatives which address low risk but high probability events. The recent catastrophic events offer substantial evidence that the events are non-linear and that there data limitations on both economic and financial models to assess: (a) the opacity of the exposure on a geographic basis and (b) the leverage of financial firms are anything but rare.

3. Methodology

This study follows the interpretivist approach by seeking responses to research questions derived from the review of the literature. Five questions were posed to 150 bank executives from the second Federal Reserve District, each question seeking specific input; more than one choices were available for each of the questions.

The objective of the questionnaire was twofold: (a) get preliminary information on the perception of bank executives regarding the impact of extreme weather due to global warming on the risk exposure and the performance of their organizations and (b) identify possible actions/initiatives that bankers are considering

3.1 Identification of Type of Bank

Please respond to the following by checking the appropriate box that applies to your Bank:

- ☐ Money Center Bank
- ☐ Regional Bank
- ☐ Community Bank

- ☐ Mortgage Bank
- ☐ Federally Chartered Bank
- ☐ State Chartered Bank

Question 1: Operations and Concerns

Which of the following are you concerned with as a result of the impact of severe climate changes:

- ☐ Bank Operations
- ☐ Bank Investments
- ☐ Bank performance

Question 2: Operations and Concerns

What are your biggest concerns relating to severe climate changes:

- ☐ Higher operating costs
- ☐ Losses
- ☐ Repricing Assets

Question 3: Initiatives

Which of the following have you considered as a result of your concern for severe climate changes:

- ☐ Monitor concentration of mortgages in high risk areas
- ☐ Have decreased the investment in carbon sensitive industries
- ☐ Considered disclosing climate risk assessment in the documents
- ☐ Have formulated working groups on severe climate related risk assessment
- ☐ Engaged in ex-ante sectoral review of weather related risk assessment
- ☐ Engaged in ex-post sectoral review of weather related risk assessment
- ☐ Have implemented stress assessment test on bank operations
- ☐ Have expanded the use of weather related derivatives

Question 4: Constraints

Have you experienced pressure from Bank regulators to consider weather related risk assessment plans

- ○ Yes
- ○ No

Question 5: Constraints

What are some of the obstacles that prevent your Bank from introducing weather related assessment plans? Multiple answers are possible.

- ☐ Data Availability
- ☐ Risk modelling challenges
- ☐ Governance Issues

3.2 Survey Narrative

Hello my name is Demetri Tsanacas and I am a faculty member of the Economics, Finance and Global Business Department at the Christos Cotsakos College of Business at William Paterson University.

The recent hurricane that hit the East Coast, the West Coast wild fires, the intense heat in the South and other catastrophic events are, in my estimation, having a profound and lasting economic and financial effects for the USA economy. The financial services industry is among the industries that has been impacted at both the operational and the investing areas and has been exposed to substantial risk.

I would like to invite you to take part in my research project by responding to a short survey that considers the impact of the extreme climate change on the financial institutions of the Second Federal Reserve District. Your response is strictly anonymous only cumulative responses will be presented in the data collected.

I would like to thank your for your time and I will be more than happy to share with you're the results of the research project.
Best Wishes
Demetri Tsanacas Ph.D.

4. Data Presentation and Analysis

The survey was offered through the William Paterson University XM Quantrics and was available for a 2 week period.

There were 20 completed responses for a 14% response which is considered to be acceptable given the time period that the survey was posted.

1. Type of Bank: all of the responses were from nationally chartered money center banks.

2. Operational Concerns: all 20 respondents were concerned with the impact of the extreme weather on the operations and the bank performance and 12 were concerned with the investment strategies. There were concerned about the costs of the operations and the losses resulting from repricing of the assets.

3. Initiatives: the majority of the initiatives undertaken by the banks over 90% revolved around the concentration of the mortgages in high risk areas as well as the investment in carbon sensitive industries. There were 30% indications of initial discussions on formulating working groups to deal with weather related risk assessment and 20% indications that there are shifts towards disclosing weather related exposure in bank documents. There were only scattered responses of use of weather derivatives 10% and the use of stress tests on bank operations.

4. Constraints: the majority of the responses 80%, indicated that the limited availability of data and the weather related modelling issues are the main constraints to the in depth assessment and managing of risk related to extreme weather.

Based on the responses an argument could be made regarding the apparent need for the development of forward-looking approaches grounded in scenario-based analyses that combine numerous risk assessment variables.

Range of Practices:
Given these emerging risks we need to assess the current actions of large financial institutions on the following: identification, monitor, and management. Given that this area in not only new, but also rapidly evolving, there are not established best practices or industry standards.

Nevertheless, some emerging themes are emerging from the largest, most complex financial institutions. Items to address are: governance, risk identification and management, scenario analysis, and transparency.

Governance:
Boards of directors and senior management should be increasingly attuned to the risks posed by climate change as pressure from various stakeholders intensifies. For example, some firms could establish internal climate-related working groups to develop enterprise-wide climate frameworks and to ensure climate considerations such as geographic concentrations or regulatory changes and to ensure that these are better integrated into strategic decision-making.

In addition senior leaders need to be discussing risk materiality in geographic and sectoral reviews, the impact that the weather poses on the production and distribution supply chain. Once they have working knowledge on the climate risk

exposure, they should be working on forward-looking climate scenario analyses. Few firms, however, have formally modified or qualified enterprise-wide risk appetite statements to acknowledge climate change.

Risk identification and management:
Senior management at some firms are beginning to assess how gradual changes in climate impact operational resilience and the potential for business disruption. Several conduct periodic disruption simulations with predictive weather modeling as part of their resiliency programs.

This work builds on experience managing risks posed by disaster events, including severe weather, to their operations and infrastructure such as branches, equipment and data centers. This includes updating disaster response playbooks and business continuity plans to address the resultant operational risks.

In terms of credit and market risk, some firms are building ex-ante climate risk assessments into sectoral or industry reviews, while others are considering the role of climate change within traditional ex-post assessments of exposures and loss estimates related to severe weather events like wildfires, hurricanes, and flooding.

Examples include: heightened monitoring of mortgage concentrations in high-risk areas, modified risk limits or reduced tenors for transactions to certain carbon-intensive sectors, and consideration of climate risk disclosures in offering documents.

Banking sector: Bank portfolio of assets consist of loans to corporations, to households, to commercial real estate firms, as well as, corporate bonds, and government bonds of all three levels of government: federal, state and local. An exposure analysis is necessary for all three customer groups with respect to the size of the exposure, the current mitigation plans and the adaptation plans.

A climate stress test to assess risk that would involve a variety of stakeholder groups such as climate scientists, industry experts, and customers would be important to gaining valuable information. It should be pointed out that this test is different than the insurance stress test

Climate-related scenario analysis:
Climate related scenarios is an emerging practice at multiple firms to identify lending portfolio sensitivity to both physical and transition risks. For physical risk scenarios, this might include stressing mortgage lending in discrete geographies against both publicly available natural hazard scenarios and internally generated severe weather simulations. For transition risk scenarios, some firms are using their energy lending portfolios as a starting point to model transition mechanisms.

Additionally, some firms are considering how to expand analysis to more indirectly impacted sectors, such as transportation and industrials, or to move beyond lending exposures to trading positions.

Firms continue to be challenged in the identification and measurement of climate risk embedded in their portfolios, with respect to mispricing, to contagion and to fire sales. The limited financial data impacts disclosures and inhibits the development of best practices and common standards.

In the context of climate change, bank supervision should focus on ensuring that appropriate risk management frameworks are in place, rather than using supervisory tools for broader objectives. That is, supervisors can focus on identifying and managing risks, both micro prudential and macroprudential, that emerge along a transition path to a more sustainable economy.

Bank supervisors, however, are not in the position to advocate for, or provide incentives for, a particular policy outcome. Those broader policy goals are the purview of elected officials and governments, and policymakers. Supervisors can and should use oversight tools to ensure financial institutions are prepared for and resilient to all types of relevant risks, including climate-related events.

Transparency:
From that perspective, climate change introduces challenges for supervisors related to time horizon, data limitations, and inherent complexity. One question that gets particular attention centers on time horizon and prioritization. More specifically, given the many risks that financial firms face—cybersecurity, geopolitical uncertainty, and the credit cycle to name a few—and the relatively long time horizon around climate change, why should supervisors focus on weather related risk?

5. Conclusions

The following points are derived from the analysis and the comments presented above:

Point 1:
The current evidence suggests that climate change affects financial firms. In addition the evidence continues to grow that climate change is affecting economic and financial outcomes. The evidence from climate science also suggests that some further physical climate impacts are locked-in due to past emissions.

Some investors consider an assessment of sustainability to be integral to their fiduciary responsibilities. And, it has been pointed out in the previous section supervised firms are choosing to build capacity in this areas, so supervisors need to understand and assess these changes. This is a risk management question for today with direct implications for safety and soundness.

Point 2:
Given the complexity of the problem, it is important to build data, models, and intellectual capacity to address risks as they arise in the future. It took some time for the financial system to develop stress testing capabilities for more familiar and arguably less complex risks like credit card losses or shocks to asset values from interest rate spikes. The economics of climate change are more complex with feedback effects, non-linearities and massive uncertainty that will require substantial investments to understand.

Point 3:
Third, financial markets and institutions face the potential for a "Minsky moment" related to climate change—an abrupt repricing of assets in response to a catastrophic event or change in investor perceptions. Actions should be taken by policy makers.

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