Non-Financial Risks

Issues and strategies for successful stress testing & portfolio management

Date: 16 January 2025

AGENDA

Characteristics of NFRs

Explore non-financial risks and how they impact portfolio performance under stress

Non-Financial Risks

Emerge from people, processes, systems, and external events *not determined by* Credit, Market, Liquidity or financial conditions

NON-FINANCIAL RISKS HAVE BEEN IN THE SPOTLIGHT SINCE THE BASEL ACCORD –

OPERATIONAL, LEGAL AND COMPLIANCE RISKS ARE CENTRAL TO THE BASEL FRAMEWORK

NFR'S HAVE GROWN TO INCLUDE A BROAD SET OF EXTERNAL RISKS –

EXAMPLES ARE GEOPOLITICAL, GENERATIVE AI AND ESG RELATED RISKS

AS WITH FINANCIAL RISKS,

NON-FINANCIAL RISKS ARE LINKED TO UNCERTAIN OUTCOMES AND LOSSES

NON-FINANCIAL RISKS

Core Risks
- Operational Risk
- Legal Risk
- Compliance Risk
- Regulatory Risks
- Model Risk
- Tail Risk
- Solvency Risk
- Settlement Risk

Other Risks
- Strategic Risk
- Reputational Risk

Information & Technology Risks
- Cybersecurity & IT Risks
- AI

ESG Risks
- Envronmental Risk
- Social Risk
- Governance

Geopolitical Risks

Top 5 Risks are Non-Financial

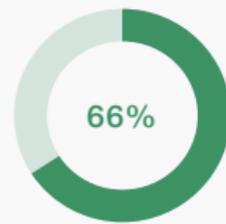Less traditional Non-Financial Risks are on the rise, and are prominent in surveys of industry participants[1]

FIGURE B | **Current risk landscape**

"Please select up to five risks that you believe are most likely to present a material crisis on a global scale in 2024."
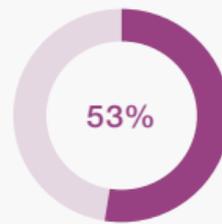
Risk categories

- Economic
- Environmental
- Geopolitical
- Societal
- Technological

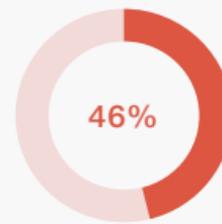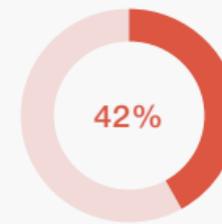| 1st	2nd	3rd	4th	5th
66%	53%	46%	42%	39%
Extreme weather	AI-generated misinformation and disinformation	Societal and/or political polarization	Cost-of-living crisis	Cyberattacks
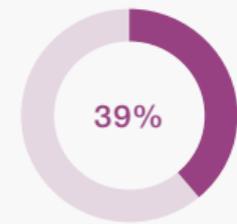
Source

World Economic Forum Global Risks
Perception Survey 2023-2024.

1. WEF 2024 survey of 11,000 business leaders in 113 economies identifies risks that post the most severe threat over the next two years

Today, Risk Managers are most concerned about newly emergent Non-Financial Risks

2024 RiskMinds Conference Survey Results

RiskMinds
8,258 followers
1w • 🌐

What will be the biggest challenge of 2025?

Regulatory requirements	9%
Geopolitical risk ✓	60%
AI risk & misinformation	25%
ESG & climate risk	6%

Banks are absorbing increasing Operational, Compliance and Legal costs which cannot be passed on to clients

Operational losses (including Cyber Risk) are material and increasing each year
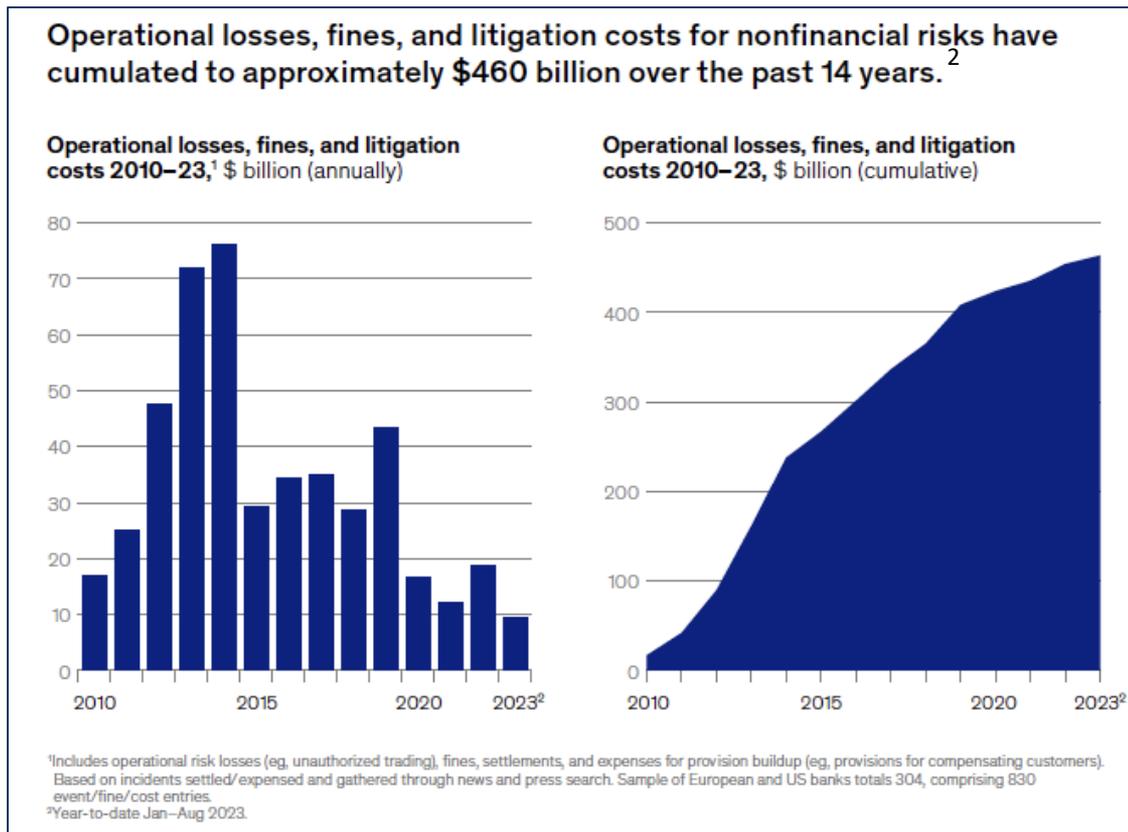

Operational losses, fines, and litigation costs for nonfinancial risks have cumulated to approximately $460 billion over the past 14 years. [2]

Operational losses, fines, and litigation costs 2010–23,[1] $ billion (annually)

Operational losses, fines, and litigation costs 2010–23, $ billion (cumulative)

[1]Includes operational risk losses (eg, unauthorized trading), fines, settlements, and expenses for provision buildup (eg, provisions for compensating customers). Based on incidents settled/expensed and gathered through news and press search. Sample of European and US banks totals 304, comprising 830 event/fine/cost entries.
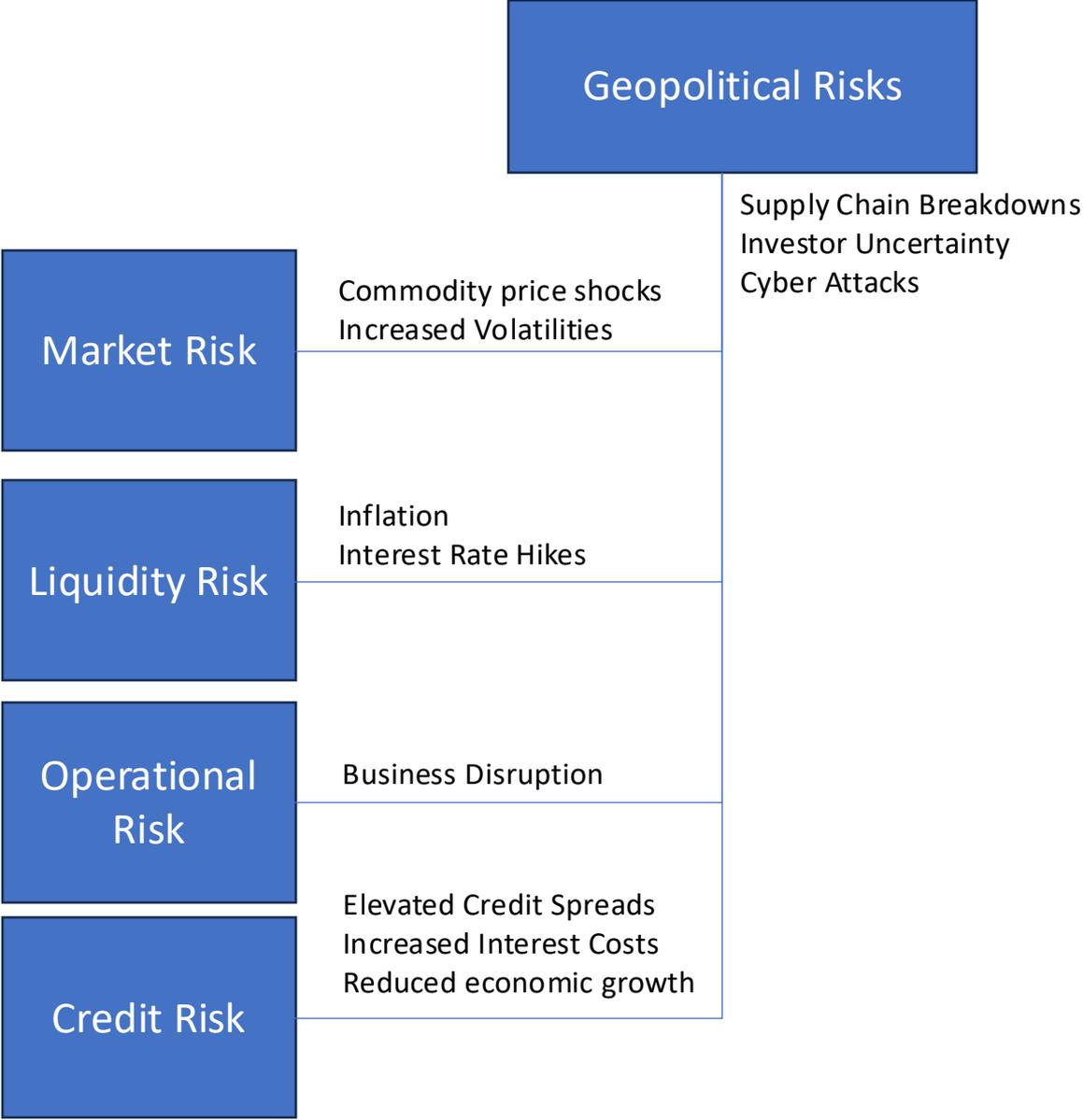[2]Year-to-date Jan–Aug 2023.

Rising Risks

- Cybersecurity threats
- Third-party vendor risk
- IT complexity and systems failures
- Conduct risk[3]
- Data privacy breaches
- Climate physical risks
- Artificial intelligence misinformation and misuse

2. How a defined risk appetite can improve nonfinancial risk management, Björn Nilsson, et. al., October 2023
3. 11th edition of the European SSM Roundtable/International Bankers Forum, Maria Delgado, Deputy Governor Central Bank of Spain, November 2019. The importance of IT has soared, which makes cyber risk an even greater source of concern. Considering scandals across the EU Anti-Money-Laundering is more relevant than ever. Conduct risk retail banking business is a major source of concern.

Non-Financial Risks can lead to Systemic Risk and Financial Losses

Relationship between Non-Financial & Financial Risks

Geopolitical Risks

Supply Chain Breakdowns
Investor Uncertainty
Cyber Attacks

Market Risk

Commodity price shocks
Increased Volatilities

Liquidity Risk

Inflation
Interest Rate Hikes

Operational Risk

Business Disruption

Credit Risk

Elevated Credit Spreads
Increased Interest Costs
Reduced economic growth

Challenges of forecasting Non-Financial Risk outcomes

Issues faced by Banks in managing Non-Financial risks

Challenges of Non-Financial Risk Assessment
Banks face a wide range of issues in managing NFRs

Complex relationships between NFR's and Financial Risks

Interconnectedness complicates stress scenario design

Challenge of Specifying linkages between NFR's, drivers and losses

Tail Risk – uncertainty around outcomes

Policy actions and investor/social response

Lengthy time horizons

Credibility of scenario forecasts

Lack of Historical Precedent

Model Risk – coefficients estimated without data reflecting response to risks may be biased

Potential to under-estimate losses

Pace of change during Crisis periods

Keeping Pace with Rapidly Changing Severity levels

Defining stress scenarios when the Baseline outlook is shifting

Managing volume of demands

Integration with Risk Management

Infrastructure & data to execute tailor stress tests to NFR's

Risk Appetite – degree of loss a bank is willing to absorb

Limit Setting – amount of business a bank is willing to conduct

Governance of heterogeneous risks

BoD Engagement and transparency

Review and Challenge Expertise

Committee structure

Interconnectedness of Non-Financial Risks
The 2020 Pandemic episode revealed vulnerabilities to other NFR's

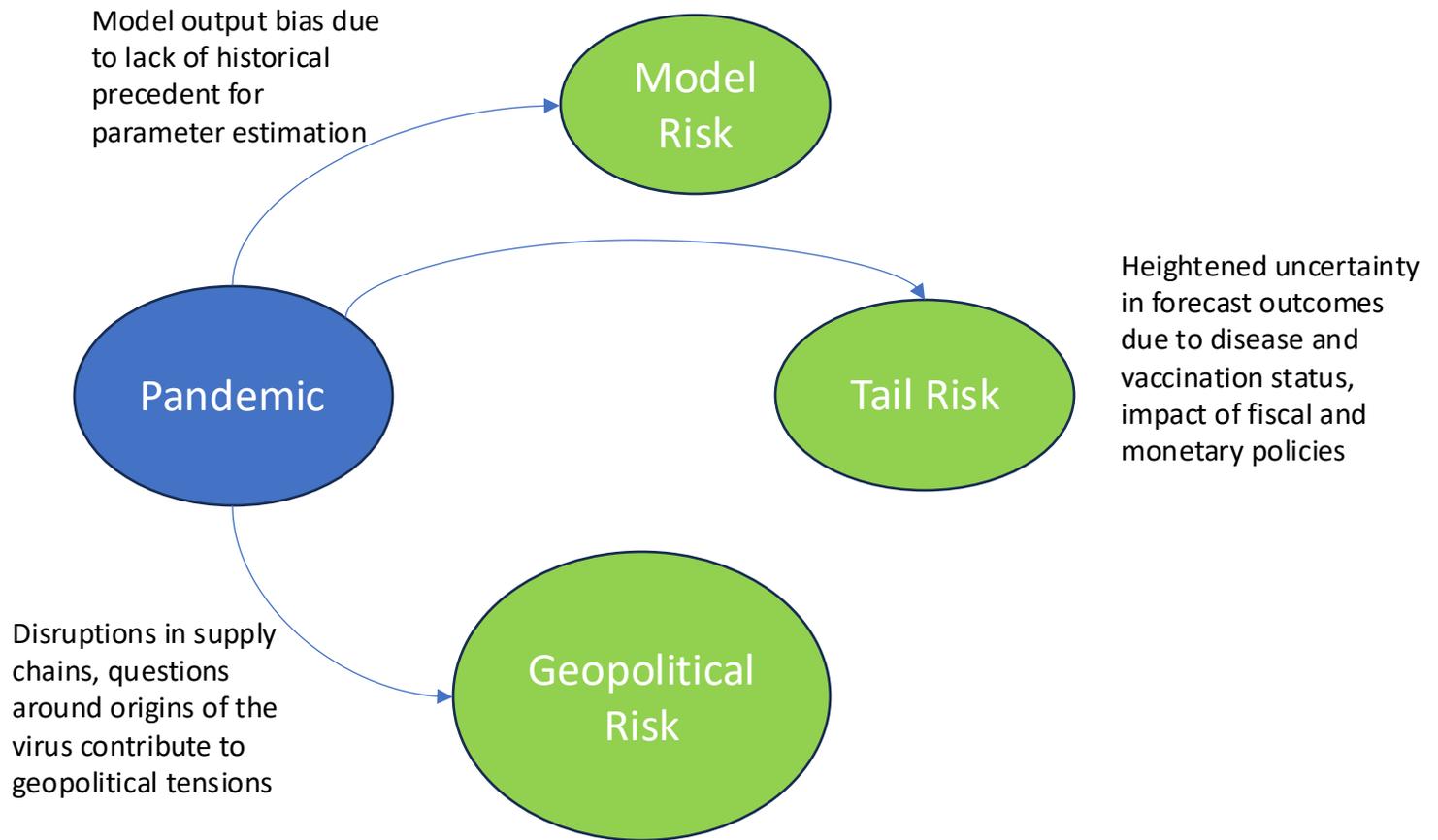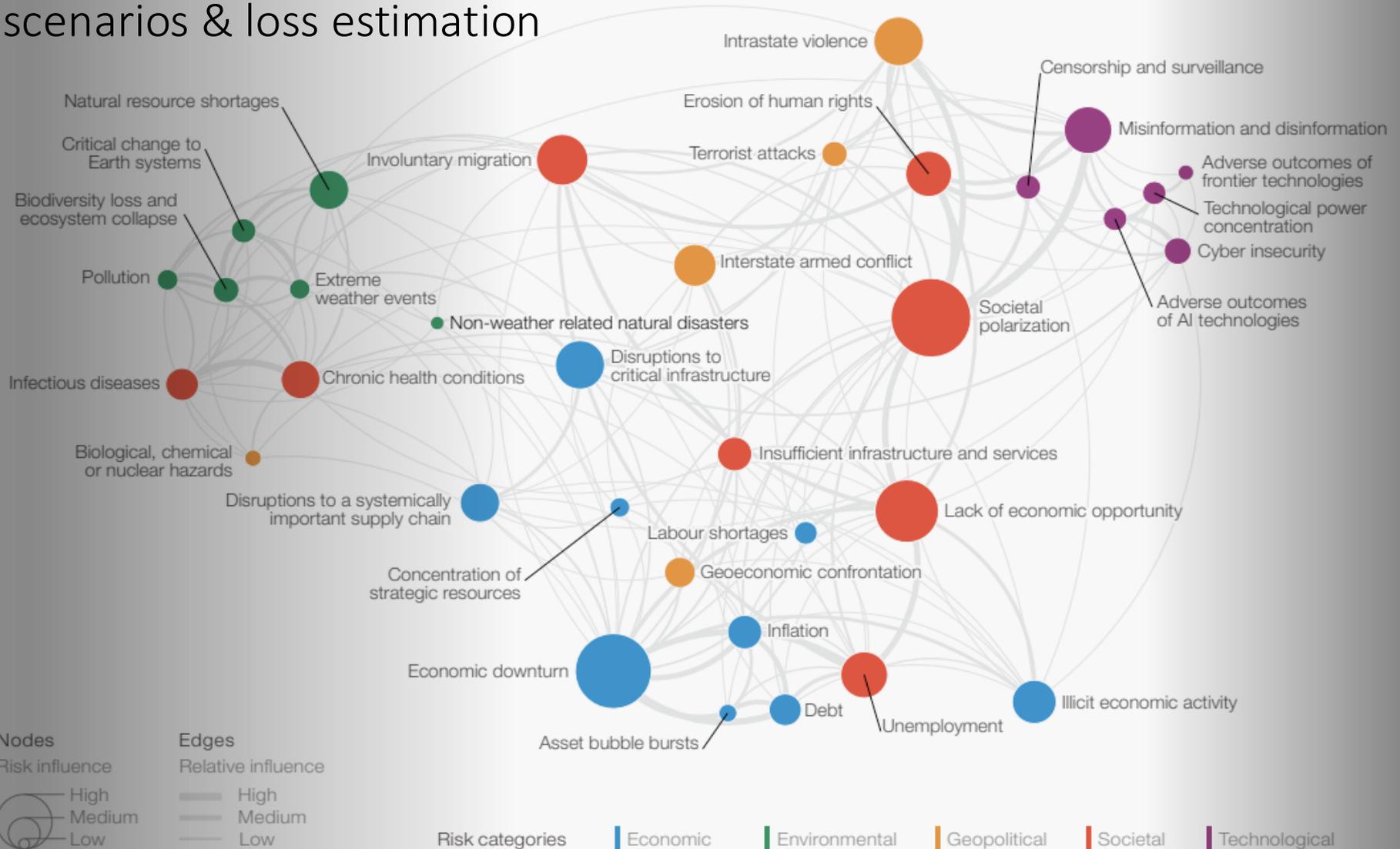# Interconnected NFR's increase the complexity of specifying stress scenarios & loss estimation

FIGURE D | Global risks landscape: an interconnections map[4]

Methodologies and Strategies

Approaches to measurement and management of Non-Financial Risks

Scenario Development
Financial Risks of NFR's may be broken into constituent parts

Structural stress tests call for linkages between macroeconomic/market dynamics and subsequent ripple effects on bank portfolios

Nature of the Non-Financial Risk
- Markets and sectors impacted

External Factors
- Government intervention
- Technological advances
- Societal and investor norms
- Bank Portfolio Strategy

Transmission Channels
- Supply Chains
- Energy
- Trade

Knock-on Effects
- Price & Rate Instability
- Liquidity risks

External Factors are important determinants of NFR outcomes

- External Factors played a major role in stemming economic and financial risk from the 2020 Pandemic

- Government policies were multi-pronged including liquidity facilities, accommodative monetary policies, fiscal stimulus

- Societal Factors such as consumer spending in response to fiscal support and vaccine adoption rates influenced the economic recovery

- Technological advancements contributed to the early introduction of vaccines

Deeper economic contraction but quick rebound in GDP, corporate spreads increased far less during the Pandemic

Taxonomy – Why it Matters

Common language with the business, senior management, and BoD

Proliferation of NFR's calls for structured analysis of emerging risks and drivers of loss outcomes

Clarifies Specification of Scenarios and Assumptions

Establishes historical "landmarks" for analysis of risks going forward in time

Benchmark loss estimates with business input

Example Taxonomy of Risks
New AI-Related Risks have emerged with the advent of Generative AI

Taxonomy should be robust to emerging risks to remain relevant in stress testing

AI Risks

- Machine Learning AI
- Generative AI
  - Misinformation/ Disinformation
    - Election Outcomes
      - Fiscal Policies (e.g., Taxation)
      - Trade Policies
      - Regulation
  - Automation
    - Financial processes (general ledger reconciliation)
    - Regulatory Reporting
    - Credit Decisioning
    - Invoice management
    - Scheduling
    - Forecasting (Weather, Real Economy)

    Service Sector Labor Force Disruptions
  - Energy Consumption
    - Operational Risks (e.g., Business Disruptions)
    - Climate Change (e.g., Emissions Risk)
    - Nuclear Power Risks

Tail Risk and Uncertainty in Outcomes
Heightened uncertainty is characteristic of Non-Financial Risks

Key Drivers

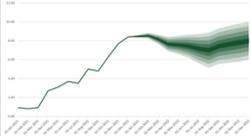- Geopolitical environment

- Unexpected changes in regulation

- External events

- Policy actions

- Investor and consumer sentiment

- Lengthy time horizons (e.g., Climate Change)

Strategies to Address Scenario Uncertainty

Methods to address uncertainty are crucial to the avoidance of loss underestimation

Generate Multiple Scenarios	Shorten the Time Horizon	Anchor Stress Scenarios in a consensus scenario or baseline outlook	Quantitative assessment where distributions of possible outcomes are presented[4]
✚ Capture of extreme outcomes that otherwise might not be considered using different sets of assumptions	✚ Fits with business planning horizon	✚ Starts from a point of credibility (i.e., "How much worse can it get")	✚ Comprehensive. Yields scenario distribution and probability estimates
▬ Resource Intensive Senior Management often looks for a single recommendation	▬ Impacts Scenario Plausibility – may not capture the business cycle or reflect true evolution of the scenario	▬ Does not eliminate the forecast uncertainty of a stress scenario	▬ Difficult to interpret the evolution of a scenario and economic relationships[5]

4. Fan Chart: The Art and Science of Communicating Uncertainty, Bank of International Settlements, September 2016
5. https://en.econreporter.com/56972/bank-of-england-to-retire-fan-chart-bailey/, Econ Reporter, March 22, 2024

Multiple Scenarios
Pandemic Tail Risk

A host of external factors contributed to uncertainty in the economic outlook

- Rapid Pace of the Covid-19 spread globally
- Vaccine introduction and adoption rates
- Fiscal stimulus and impacts on consumption and investment
- Accommodative monetary policies
- Impact of technology and remote work

Banks faced data gaps …

- Unprecedented economic severity – relative stress at trough
- Model Risk - Lack of recent and directly relevant Pandemic and Inflationary episodes

Figure 3. Real GDP growth in the severely adverse and alternative downside scenarios, 2018:Q4–2023:Q1

Percent

Actual
Severely Adverse
V-shaped
U-shaped
W-shaped
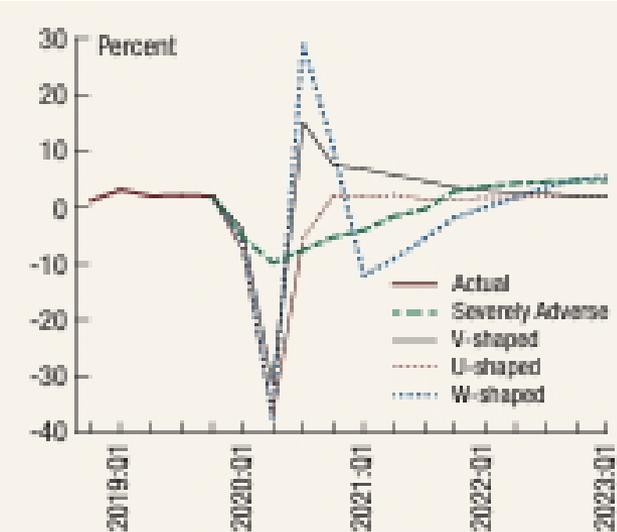
Source: Bureau of Economic Analysis for historical data and Federal Reserve assumptions for the severely adverse and alternative downside scenarios.

High degree of uncertainty led the Federal Reserve to introduce an interim stress test exercise with 3 Alternative Scenarios in September 2020

Climate Transition Risk – Tragedy of the Horizon

Climate Transition scenarios are fraught with a wide range of assumptions and have long time horizons which in turn can lead to a wide range of outcomes

"the catastrophic impacts of climate change will be felt beyond the traditional horizons of most actors…" Climate risk extends beyond the business cycle, political cycle, and horizon for central banks to act beyond current mandates.[6]

LOSS

Forecast uncertainty increases in relation to the scenario time horizon

2100   TIME
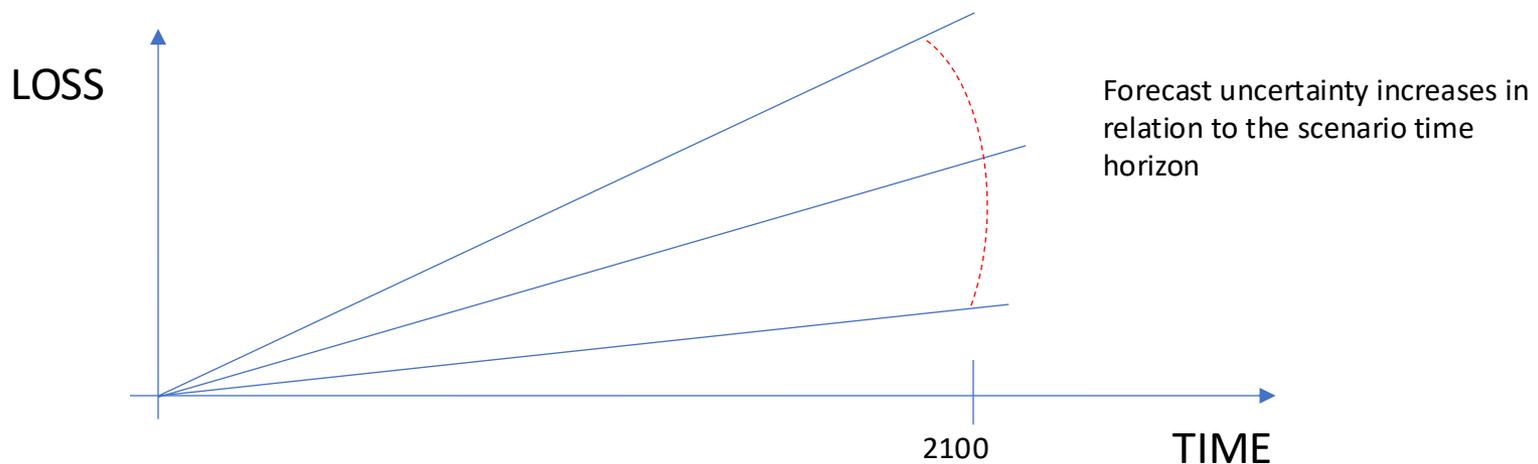
6.   Breaking the tragedy of the horizon – climate change and financial stability, Speech by Mark Carney, Governor of the Bank of England and Chairman of the Financial Stability Board, 29 September 2015

Shortening of Time Horizons

Shorter time horizons call for adjustment to scenario assumptions

- Many institutions have adopted shorter scenario timelines (NGFS short term 3–5-year scenarios)
- Scenario assumptions are challenged by reality of current environment
  - Carbon prices globally range from $0.46 to $167 USD, only 1% of prices are above the recommended levels [7]
  - How realistic are scenarios that envision carbon pricing globally?

Carbon price (USD/tCO$_2$) [8]

Sources: NGFS phase II and ECB calculations.
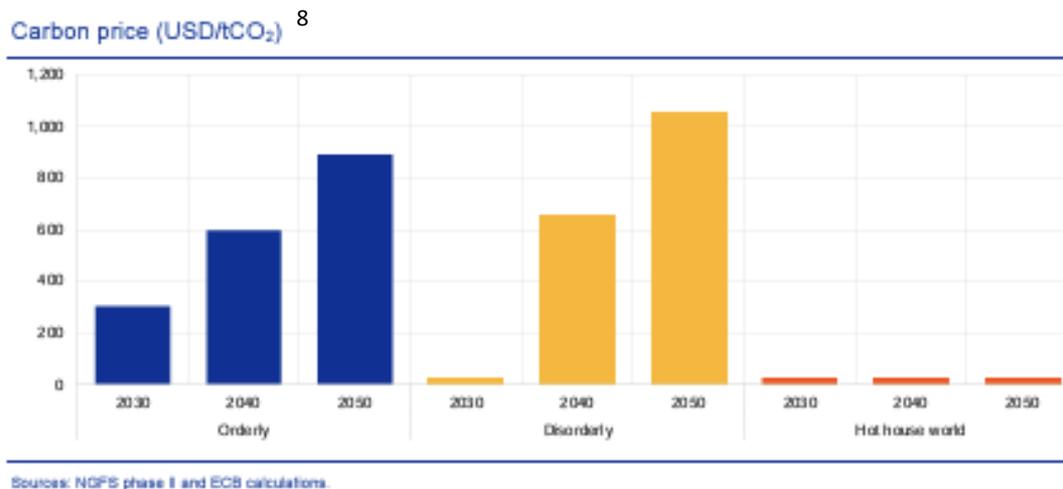
7. https://carbonpricingdashboard.worldbank.org/compliance/price, World Bank Group, 2025
8. Mapping Climate Risk: Findings from the EU Pilot Exercise, European Banking Authority, May 21, 2021

Reducing Scenario Uncertainty
Addition of information can contribute to greater precision in impact assessments

- The National Hurricane Center revised its "cone of uncertainty" in 2024 in response to criticism that it did not provide adequate information about a storm's potential impacts

  - 2002 cone designed for landfall and path of storm

  - 2024 revision superimposes watches and warnings for inland storms, improving risk assessment[9]

Example Graphic of 5-Day Track Forecast Cone:
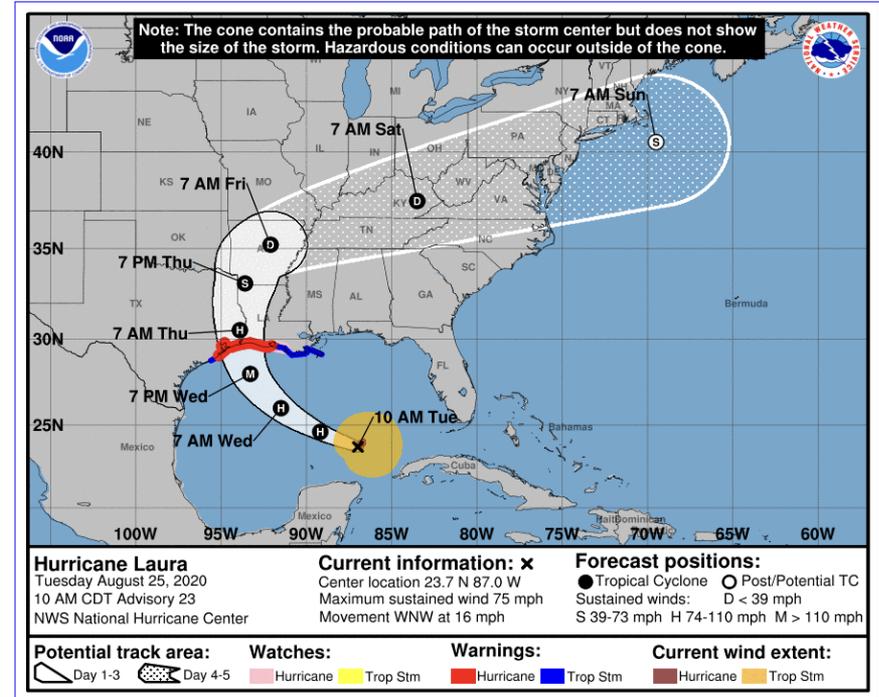
9.   National Oceanographic and Atmospheric Administration, https://www.nhc.noaa.gov/aboutcone.shtml

Estimating NFR Losses

Integrating NFR stress scenarios with credit and other loss estimates

Linking NFR's to Financial Losses can be challenging

Can be difficult

- Impacts of NFR's are difficult to quantify
- Pre-existing models may not be designed to best capture these characteristics
- Unique characteristics of NFR's call for new data and methods

Best Practices

- Advance loss model parameter estimates over time. Many NFR's have become chronic (Climate Risk) and/or (AI Risk) are expanding setting historical precedent
- Increase granularity, including sector and region-specific inputs
- Combine traditional top-down forecast approaches with bottoms up analysis of obligors and counter-parties

Linking NFR Scenarios & Financial Losses

Loss models are changing to address non-financial risks

Loss models are evolving to be more granular, incorporating more detailed inputs at the counterparty/obligor level

Top-Down Inputs

GDP
Real Estate (NOI, Cap Rates)

Credit Loss Inputs

(PD, EAD, LGD)
Estimates

Differentiated approaches to PD, LGD models

Increased granularity of systemic factors

Calibration of transition matrices, other models for within sector counterparty dynamics

NFR Inputs

- Sector specific GVA's
- Regional Factors (e.g., trade policies, carbon markets)
- Counterparty Factors (e.g., climate transition plans)

Bottom-Up Inputs

Internal Ratings
Cash Flows
Financials

Re-Calibration of obligor financials

Dynamic Adjustments to Ratings

Time varying nature of obligor ratings is highlighted in energy share transition scenarios

Energy Demand Fossil Fuels: Remind-MAgPIE 3.3-4.8 NGFS Delayed Transition[10]

model: GCAM 6.0 NGFS, scenario: Delayed transition, region: World

10. Network for the Greening of the Financial System Scenarios, Version 5
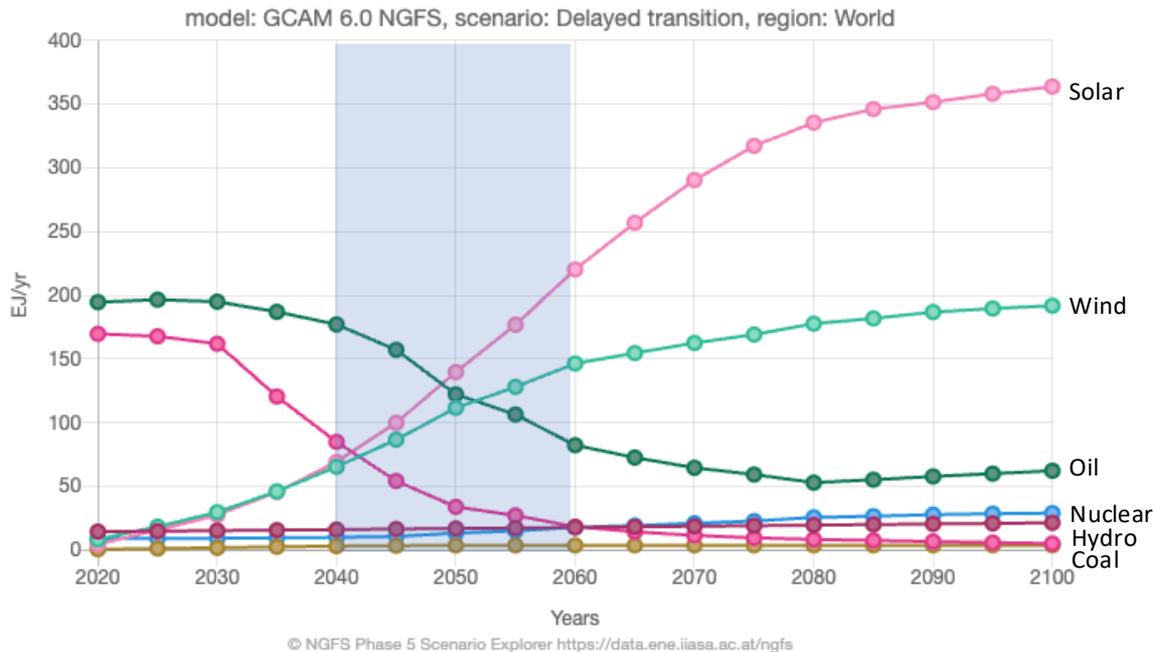
Model Risk - Adequacy of Risk Assessment Tools for NFR Loss Estimation

Analogous to Banking, the Insurance industry is also experiencing challenges with NFR's

- "Insurance models struggle to factor, with any precision, the probabilities that are accruing from climate change"[11]

- Recent Example: L.A. Wildfires in January 2025 are expected to cost +$50B USD

Last year had a record number of billion-dollar insured losses from extreme weather

US   Non-US Americas   Apac   EMEA
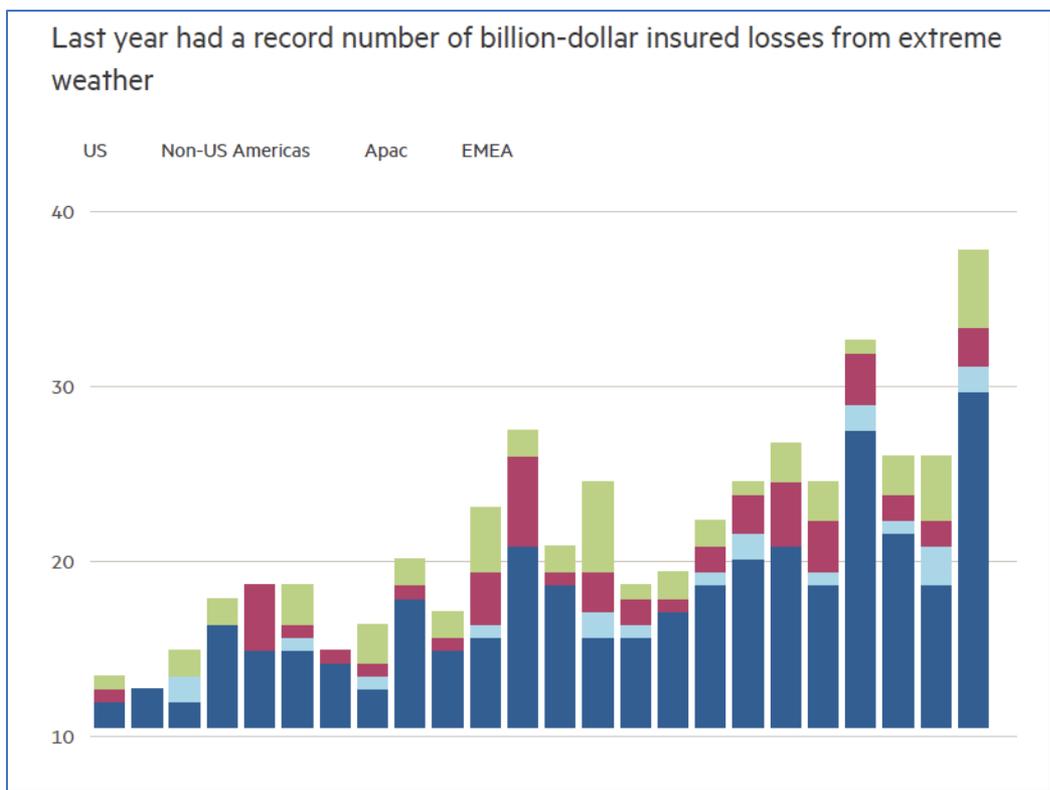
Historical information does not fully capture recent increased frequency & severity of events

11.   The uninsurable world: how the market fell behind on climate change, Ian Smith Kenza Bryan, June 2, 2024

Model Risk
Model Risk increases with a changing environment, raising the potential for biased loss estimates

- *"Model risk should be managed like other types of risk. Banks should identify the sources of risk and assess the magnitude. Model risk increases with greater model complexity, higher uncertainty about inputs and assumptions, broader use, and larger potential impact."*[12]

- *"*challenges include limited data, lack of back-testing capabilities, non-linear, risks, scenario horizon, *heavy reliance on judgment, limited reliability of model output, and time constraints."*

12. SUPERVISORY GUIDANCE ON MODEL RISK MANAGEMENT SR11-7, April 4, 2011, Federal Reserve and Office of the Comptroller of the Currency

Quantitative Model Shortcomings
A range of strategies mitigate limitations of quantitative assessments

Model monitoring (errors)

Increased focus on monitoring models for break-downs

Dashboarding

Qualitative overlays

Regulators are most concerned about overlooking risks

Substantiation of claims and governance are critical compensating controls to ensure integrity of overlays

Augmentation of information

New risks may require additional information to adequately differentiate performance

Example: Climate transition risk - heavy emitting sectors behave differently – their dynamics are lost in average projections of GDP

Effective Challenge

"A guiding principle for managing model risk is "effective challenge" of models, that is, critical analysis by objective, informed parties who can identify model limitations" [14]

Requires adequate 2nd line expertise and governance over model results

Factoring in Uncertainty in Loss estimates

Borrowing on concepts from accounting regimes, leverage multiple scenarios to estimate expected loss amounts (i.e., convexity adjustment)[13]

Scenario loss averages are difficult to explain to management and business but may be supportive of Qualitative overlays

13. Principles of the CECL Model 7.2, PWC, May 31, 2022
14. SR11-7

Qualitative vs. Quantitative Assessments

Qualitative loss estimates may be necessary in the absence of adequate quantitative information

*"All material risks [both Financial and Non-Financial] faced by the bank should be addressed in the capital assessment process. While the Committee recognises that **not all risks can be measured precisely, a process should be developed to estimate risks**."*[15]

Example Qualitative Assessments

- Data gaps - Insurance coverage under climate risk scenarios
- Internal ratings based on evaluation of counterparty climate transition plans
- Pandemic period inflation and interest rate dynamics

Keys to Effective QA's

- Adequate substantiation/documentation
- Compensating controls - validation and monitoring
- Effective Review and Challenge by 1st and 2nd line expertise
- Senior Management and BoD engagement and oversight

15. Basel Framework, https://www.bis.org/basel_framework/chapter/SRP/20.htm?inforce=20191215&published=20191215, Basel Committee on Banking and Supervision, 2019

Dealing with a Rapidly Changing Environment

Forecasts can be inaccurate in a volatile and changing economy

When economic deterioration is accelerating, reliance on standard monthly and quarterly series to update forecasts may not be adequate

Forward looking stress tests are *relative* to the general economic outlook

Keeping abreast of changes in the Baseline outlook is critical
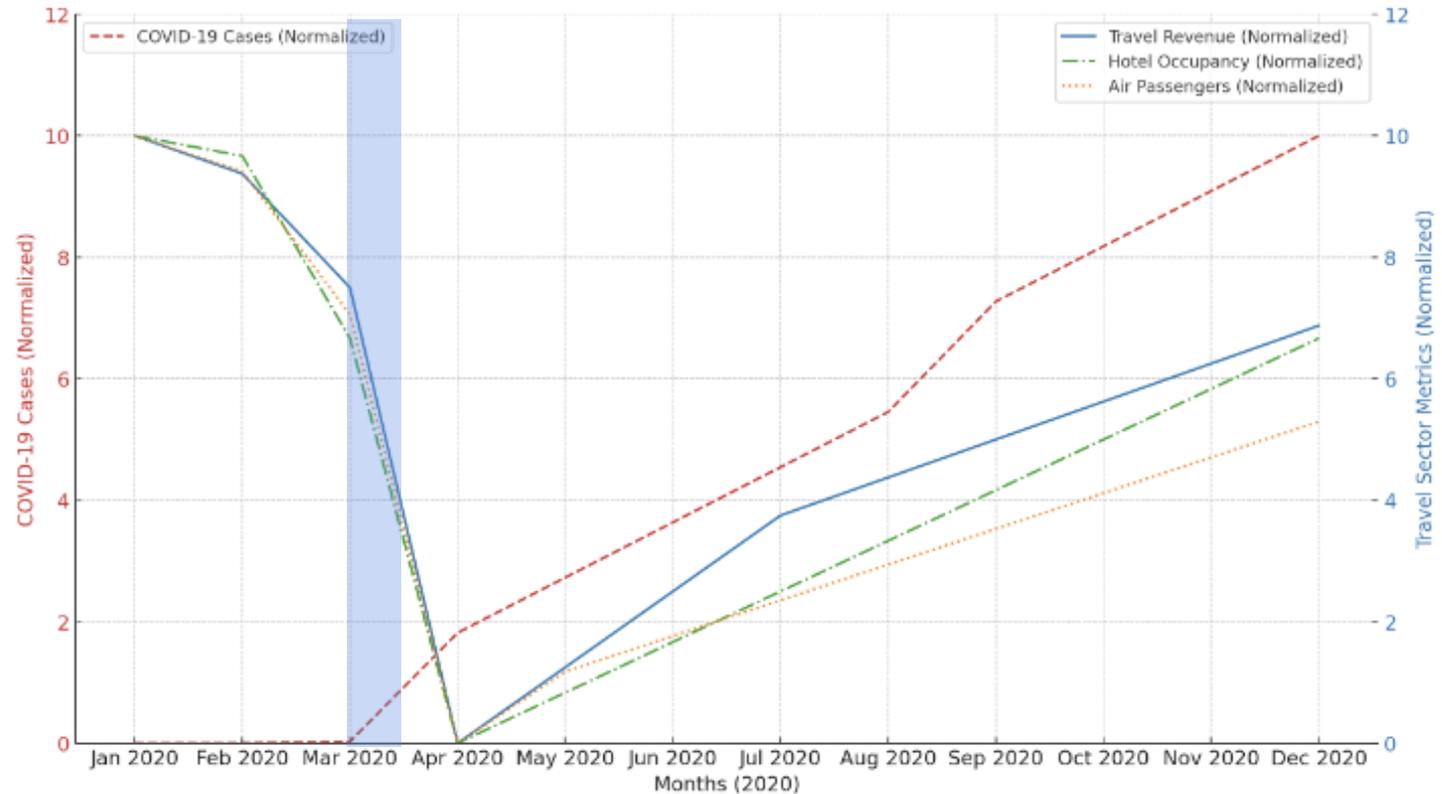
Strategies

Frequent updates to the Baseline outlook during volatile periods

High frequency data and estimation methods (e.g., GARCH, ML) can be useful in assessing short term outlook changes

Impact of COVID-19 on the Travel Sector and US Real GDP Growth (2020)

Air Passenger Miles, Hotel Occupancy vs. Travel Sector Revenues

Rise in Covid-19 cases correlated to Travel sector revenues

Rapid Stress Testing & Model Updates
Banks are advancing business processes infrastructure to streamline execution

Accelerated deterioration and non-linearities associated with recent NFR's (e.g., Bank Deposit Crisis, Pandemic) call for frequent and rapid updates to P&L impacts

- Banks have made extensive investments in analytical platforms and systems with direct linkages

- Updates to model parameters that are both more frequent and rapid

Efficient Design of economically coherent scenarios

Real Time Forecast Generation

Frequent & Rapid updates to P&L Model parameters

Direct carry through to P&L estimation and aggregation
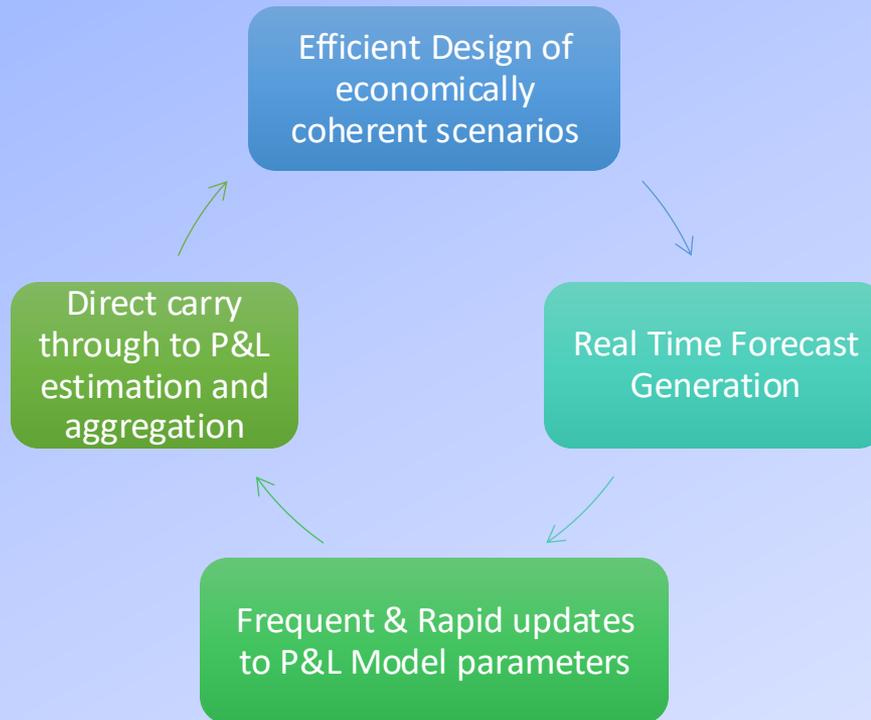
Governance of Non-Financial Risks

Successful management of NFR's requires expertise & transparency at all levels

Board of Directors
(Risk and Operating Committees)

- Capital Planning Committee
- Risk Committees (CRC, etc.)
- Working Groups
- Functional areas
- Business Units

Ultimately the BoD must choose the level of risk appetite of the Firm for NFR's

Existing committee structures may be leveraged for NFR's, lending consistency to the evaluation of risks

Organization	Practice
BU's & Functional Areas	Hire & Develop Expertise in relevant NFR areas
2nd & 3rd line Functional Areas	Hire & Develop Expertise to provide effective review & challenge
Working Groups	Draw upon Functional Area expertise and recommendations to formulate recommendations
Committees	Review and approve Financial Results and Recommendations
BoD	Sets strategic direction based on committee recommendations

Summary of Strategies

Scenario Design	NFR Taxonomy	Tail Risk	Model Risk	Rapid Change	Integration with Risk Frameworks	Governance of NFR's
•Linking NFR's and Financial Risks •Addressing complexity of inter-relationships	•Common language •Flexible structure	•Scenario Credibility	•Model updates •Qualitative Overlays	•High Frequency Data •Business Architecture to support rapid stress testing	•Limit Setting and Risk Appetite •Risk Model Updates (sector specific, ratings transition)	•Expertise •Compensating controls