FLETCHER RESPONSIBLE ASSET ALLOCATOR INITIATIVE

Pricing Climate Change Risk Premia: Adjusting CMAs for Climate-change

By
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Landmark Hotel, London

Responsible Climate Allocation Lab (RCAL)

Investors lack the ability to invest in system-wide solutions for climate change on their own

The RCAL (formerly RFBL) is a research arm of the RAAI. It provides a forum for asset allocators to learn from one another and develop:

- Solutions for climate change that overcome limitations of traditional practices
- Approaches to consider climate change in capital market assumptions (CMAs)
- Tools to systematically risk-adjust asset allocation models for climate
- Practices to both mitigate climate risks and take advantage of opportunities to improve returns

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Problem Statement

- Asset allocators have a legal requirement to be fiduciarily responsible. They must meet financial obligations.
- Allocators focus on financial materiality to justify investing in climate change.
- Current push back on “woke capital” has increased pressure.
- As long-term investors, allocators need to price the impact of climate change on their portfolios over time.

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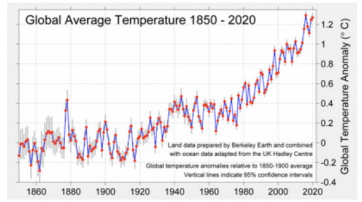
Proposition



- Capital Market Assumptions (CMAs) are key. They are used by allocators to model 10-20-year risk and return expectations
- Current CMAs are backward-looking, - 60–70% weighted toward historical returns, volatilities, and correlations. When it comes to climate, CMAs implicitly assume a world that no longer exists.
- Current trajectories point to 2.7°C of warming by century's end, with a 30% chance of exceeding 3.0°C and 12% of hitting 4.8°C.
- Mean-reverting historical anchors fail in a world entering a "fat-tailed," distributionally-shifting, climate regime.
- Asset allocators can adjust CMAs to price climate risk premia in portfolios and build resiliency.

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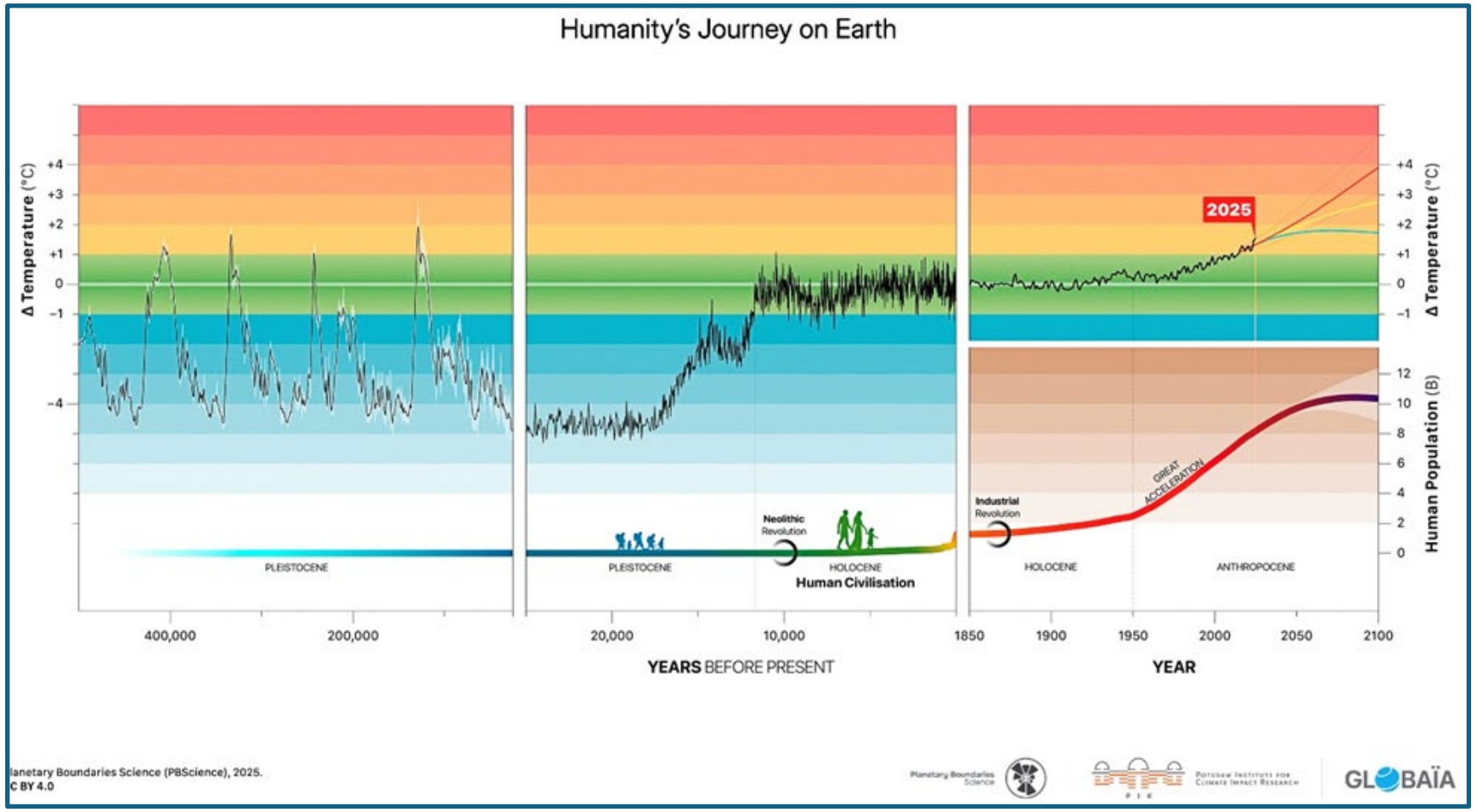
We are in uncharted territory, with little historical context



We have not breached two degrees above baseline for three million years. We are heading toward uncharted territory.

The lack of historical context and data makes traditional CMA models dangerously out of touch with the world we are headed toward.

Planetary Boundaries Science (PBScience). 2025. Planetary Health Check 2025. Page 37. Potsdam Institute for Climate Impact Research (PIK), Potsdam, Germany.

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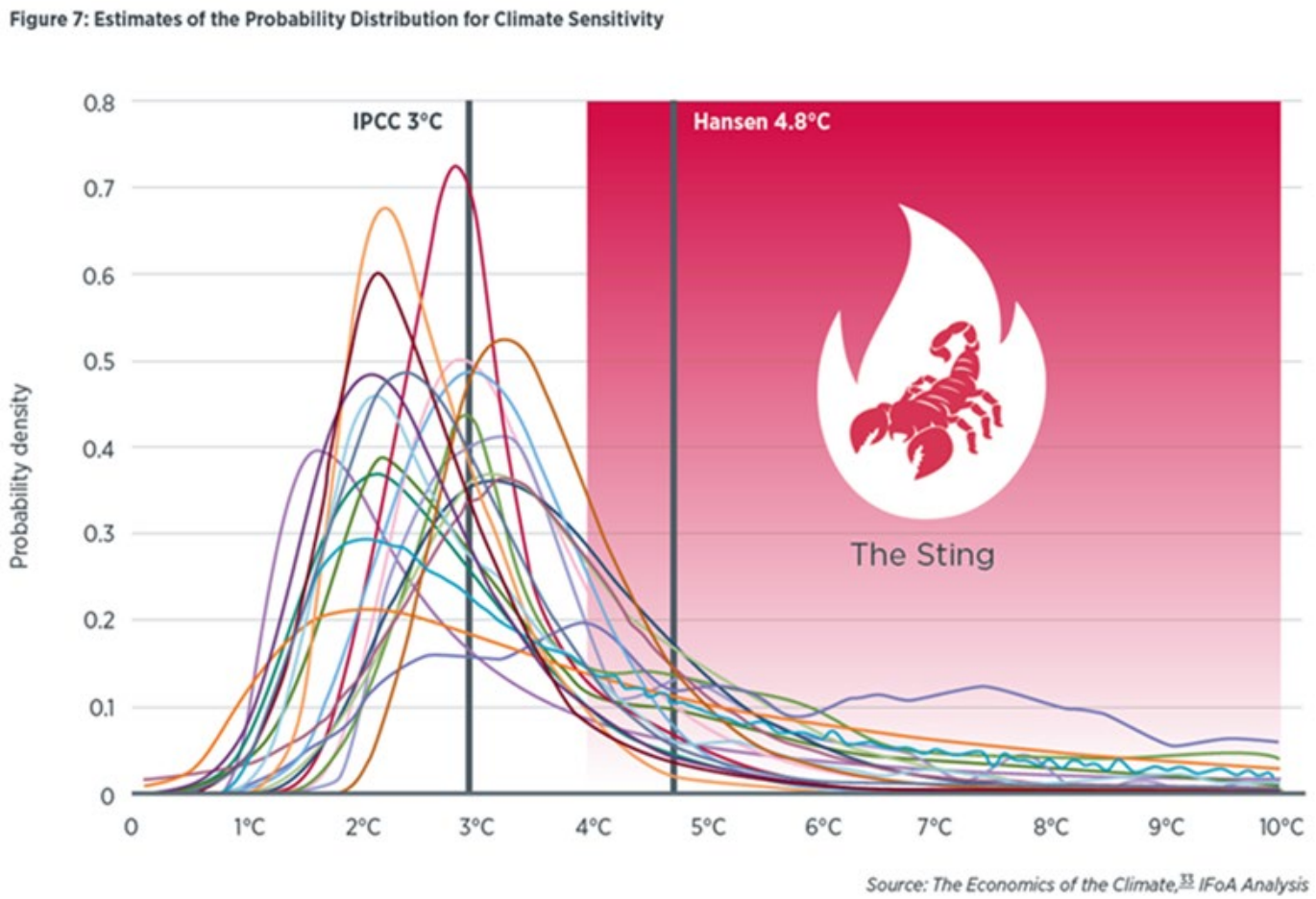
Global warming scenarios have “fat tails.”



Source: Climate Scorpion: the Sting is in the Tail, Institute and Faculty of Actuaries (IFOA)

Risks that are low probability but highly significant in impact are called “fat-tail” risks. They can be seen outside the bell curve of probable temperature scenarios extending to the right.

These events should be discounted in forward-looking risk and return models.

Global warming scenarios have very fat tails. The risk of global warming reaching 3.0-4.0 degrees above baseline, a “hot house world” scenario according to the NGFS, has risen to 30%. The risk of reaching 4.8%degrees above baseline, a disaster scenario, is now about 12%

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Climate Change Impacts on Regional Economies

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USA economic outlook deteriorates under warming climate

United States - 20 year Climate Adjusted Projections				
Indicator	Baseline	Orderly 1.5°C	Disorderly 2.7°C	Hothouse 3.0–4.0°C
GDP Growth (%)	2.2	2.0	1.7	1.5
Inflation (%)	2.3	2.6	3.2	3.5
Interest Rate (%)	3.2	3.5	4.1	4.4
Earnings Growth (%)	4.6	4.3	3.9	3.6

Notes: Analysis by Scott Kalb, Director, RAAI at the Fletcher School

Table shows baseline 20-year macroeconomic projections compared with climate-adjusted projections under three NGFS scenarios - Orderly Transition (1.5 degrees), Disorderly Transition (2.7 degrees, current trajectory), and Hot House World (3-4 degrees).

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The same is true for European economies

Europe (EU-27 + UK, Norway, Switzerland) -Climate Adjusted				
Indicator	Baseline	Orderly 1.5°C	Disorderly 2.7°C	Hothouse 3.0–4.0°C
GDP Growth (%)	1.8	1.6	1.3	1.0
Inflation (%)	2.0	2.4	2.9	3.3
Interest Rate (%)	2.8	3.1	3.6	3.9
Earnings Growth (%)	4.0	3.6	3.1	2.7

Table shows baseline 20-year macroeconomic projections compared with climate-adjusted projections under three NGFS scenarios - Orderly Transition (1.5 degrees), Disorderly Transition (2.7 degrees, current trajectory), and Hot House World (3-4 degrees).

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Emerging Markets economies hardest hit by climate, no buffers

Southeast Asia (Indonesia, Malaysia, Thailand, Vietnam, Philippines, Si				
Indicator	Baseline	Orderly 1.5°C	Disorderly 2.7°C	Hothouse 3.0–4.0°C
GDP Growth (%)	5.0	4.7	4.2	3.6
Inflation (%)	3.2	3.5	4.0	4.5
Interest Rate (%)	4.2	4.5	5.0	5.4
Earnings Growth (%)	6.0	5.5	4.9	4.3

Africa (Nigeria, South Africa, Kenya, Egypt, Morocco, Uganda) - 20 yr Cli				
Indicator	Baseline	Orderly 1.5°C	Disorderly 2.7°C	Hothouse 3.0–4.0°C
GDP Growth (%)	4.2	3.8	3.2	2.6
Inflation (%)	5.0	5.4	6.0	6.5
Interest Rate (%)	6.0	6.3	6.8	7.2
Earnings Growth (%)	5.5	5.0	4.3	3.7

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Climate Change Impacts on CMAs and Asset Classes

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Portfolio risk-adjusted returns worsen under climate change

Allocators may construct portfolios that are overly exposed to risk and damage based on misleading CMAs.

Typical Allocator Portfolio: Benchmark-Level Performance (20 Year Horizon)							
Description	Benchmark(s)	Return Est Horizon CMA	Vol. Est. Horizon CMA	Return @ 1.5°C	Return @ 2.7°C	Return @ 3.0–4.0°C	Volatility Range
Global Equities	MSCI All Country World Index (ACWI)	6.50%	13.00%	5.10%	4.20%	2.80%	13.5% – 16.0%
Global Fixed Income	Bloomberg Barclays Global Aggregate Bond Index	3.80%	6.00%	3.60%	3.30%	3.00%	6.2% – 7.0%
Private Equity	Cambridge Associates Global PE Index	9.20%	14.50%	8.50%	7.80%	6.90%	14.5% – 17.0%
Private Credit	Cliffwater Direct Lending Index (CDLI)	7.50%	8.00%	7.20%	6.50%	6.00%	8.2% – 9.5%
Infrastructure	EDHECinfra Broad Market Index	6.00%	10.50%	5.50%	4.80%	4.00%	10.8% – 13.0%
Real Estate	NCREIF Property Index (NPI)	5.50%	9.50%	5.20%	4.60%	4.00%	9.8% – 11.5%

Analysis: Scott Kalb, Director, RAAI at the Fletcher School

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Climate resilient strategies show better prospects

Climate-resilient benchmarks show higher returns with lower risk, compared to legacy benchmarks, under all climate scenarios.

Climate Resilient Portfolio: Benchmark-Level Performance (20 Year Horizon)							
Description	Benchmark(s)	Return Est Horizon CMA	Vol. Est. Horizon CMA	Return @ 1.5°C	Return @ 2.7°C	Return @ 3.0–4.0°C	Volatility Range
Climate Transition Equity	MSCI ACWI Climate Transition Benchmark (CTB)	6.50%	12.00%	6.30%	5.80%	5.20%	12.2% – 13.5%
Adaptation & Resilience Equity	Composite: MSCI Climate Action, S&P Global Water, FTSE Environmental Opportunities (Adaptation subset)	6.90%	11.50%	7.00%	6.60%	6.10%	11.5% – 12.8%
SDG-Aligned Fixed Income	World Bank Green Bond Index, JPMorgan ESG EMBI Index	4.20%	6.50%	4.30%	4.10%	3.90%	6.5% – 7.2%
Clean Tech & Impact PE	Cambridge Associates Clean Tech & Impact PE Benchmarks	9.50%	15.00%	9.80%	9.20%	8.50%	15.0% – 17.5%
ESG Infrastructure & Real Estate	FTSE Environmental Markets Index, GRESB Infrastructure Benchmark	6.00%	10.80%	6.20%	5.90%	5.50%	10.8% – 12.5%

Analysis: Scott Kalb, Director, RAAI at the Fletcher School

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Climate-optimized vs typical portfolio – better outcomes

Portfolio-Level Forecasts: Return & Volatility (10–20 Year Horizon)						
Portfolio	(Horizon CMA)		(NGFS Climate Scenarios)			
	Base Return	Base Vol	1.5°C CMA	2.7°C CMA	3-4°C CMA	Volatility Range
Typical Portfolio	6.50%	11.50%	5.10%	4.20%	2.80%	12.2% – 15.0%
Optimized Climate Resilient Portfolio	6.20%	11.00%	6.00%	5.60%	5.10%	10.5% – 12.2%

Analysis: Scott Kalb, Director, RAAI at the Fletcher School

Typical Portfolio: 50% Global Equities (MSCI ACWI), 30% Global Fixed Income (Bloomberg Barclays Global Aggregate), 10% Private Equity & Private Credit (Cambridge Associates Global PE Index and Cliffwater Direct Lending Index (CDLI), 10% Infrastructure & Real Estate (EDHEC infrastructure Broad Market Index and NCREIF Property Index (NPI))

Optimized Climate Resilient: 35% Climate Transition Equity (MSCI ACWI CTB), 15% Adaptation & Resilience Equity (Composite: MSCI Climate Action, S&P Global Water, FTSE Environmental Opportunities (Adaptation subset), 25% SDG-Aligned Fixed Income (Composite: World Bank Green Bond Index, JPMorgan ESG EMBI Index), 15% Clean Tech & Impact PE (Benchmark: Cambridge Associates Clean Tech & Impact PE), 10% ESG Infrastructure & Real Estate (Composite: Environmental Markets Index, GRESB Infrastructure Benchmark).

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Methodology, Key Differences, Conclusions

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Sources and Methodology

Climate-Adjusted CMAs (2025–2045) Methodology Summary	
Component	**Description**
Baseline Source	Horizon Actuarial 2025 Survey, IMF World Economic Outlook
Climate Adjustment Source	NGFS Phase V Explorer, IMF Climate Stress Testing Framework
Sectoral Damage Multipliers	IMF Working Paper WP/22/145 (firm level productivity studies, agriculture, energy, infra)
Physical Risk Indices	ND-GAIN Country Index (vulnerability, readiness), WRI Aqueduct 4.0 (water stress, flooding)
Aggregation Logic	Country-level weighted averages by region
Analysis: Scott Kalb, Director, RAAI at the Fletcher School	

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Key differences – unadjusted and climate-adjusted CMAs

Dimension	Unadjusted Benchmark CMA	1.5°C (Orderly Transition)	2.7°C (Disorderly Transition)	3–4°C (Hot House World)
Return Drivers	Historical averages + valuation-based forecasts	Adjusted for green innovation and sector rotation	Adjusted for abrupt policy shocks and stranded assets	Adjusted for severe physical risk and sovereign stress
GDP & Inflation Inputs	Consensus macro forecasts	NGFS orderly overlays with stable inflation	NGFS overlays with inflation volatility	NGFS overlays with stagflation and supply chain shocks
Sector Weighting	Market-cap weighted	Tilted toward low-carbon sectors	Penalizes carbon-intensive sectors	Penalizes climate-vulnerable sectors (infra, agri)
Earnings Growth	Historical trend extrapolation	Boosted by green capex and policy certainty	Lowered due to transition disruption	Lowered due to physical damage and migration pressure
Fixed Income Yields	Yield curve extrapolation	Stable rates with moderate credit spreads	Elevated spreads and downgrade risk	Sovereign fragility and inflation-linked repricing

Dimension	Unadjusted Benchmark CMA	1.5°C (Orderly Transition)	2.7°C (Disorderly Transition)	3–4°C (Hot House World)
Private Equity Dispersion	Historical IRRs and scaling assumptions	Upside from climate tech scaling	Higher dispersion due to policy volatility	Extreme dispersion; stranded innovation risk
Real Estate Valuation	Income + appreciation models	Enhanced by adaptation investment	Adjusted for permitting delays, regulatory shifts	Adjusted for location-specific damage and insurance cost
Volatility Profile	Based on historical standard deviation	Slightly elevated due to transition uncertainty	Wider bands due to policy fragmentation	Highest dispersion due to systemic physical risk
Tail Risk Exposure	Typically under-represented	Mitigated by policy coordination	Elevated due to transition shocks	Elevated due to climate catastrophe scenarios
Time Horizon Fit	Long-term strategic (20Y)	Strategic planning and net-zero alignment	Tactical stress testing and risk budgeting	Long-term adaptation and resilience planning

Analysis: Scott Kalb, Director, RAAI at the Fletcher School

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Conclusions

- Asset allocators are thinking about how to include climate change in their asset allocation models.
- Current CMAs are largely based on historical trends and data, and do not price forward looking climate change impacts, pointing portfolios in the wrong direction and over-exposing them to risk and damage.
- Climate-adjusted CMAs help asset allocators price and capture climate risk premia.
- Asset allocators should ask their CMA providers if and how they include climate in their calculations by country and by asset class.
- Asset allocators should make sure that assumptions on temperature, damage severity, and policy direction are included in their CMA models.

Appendix

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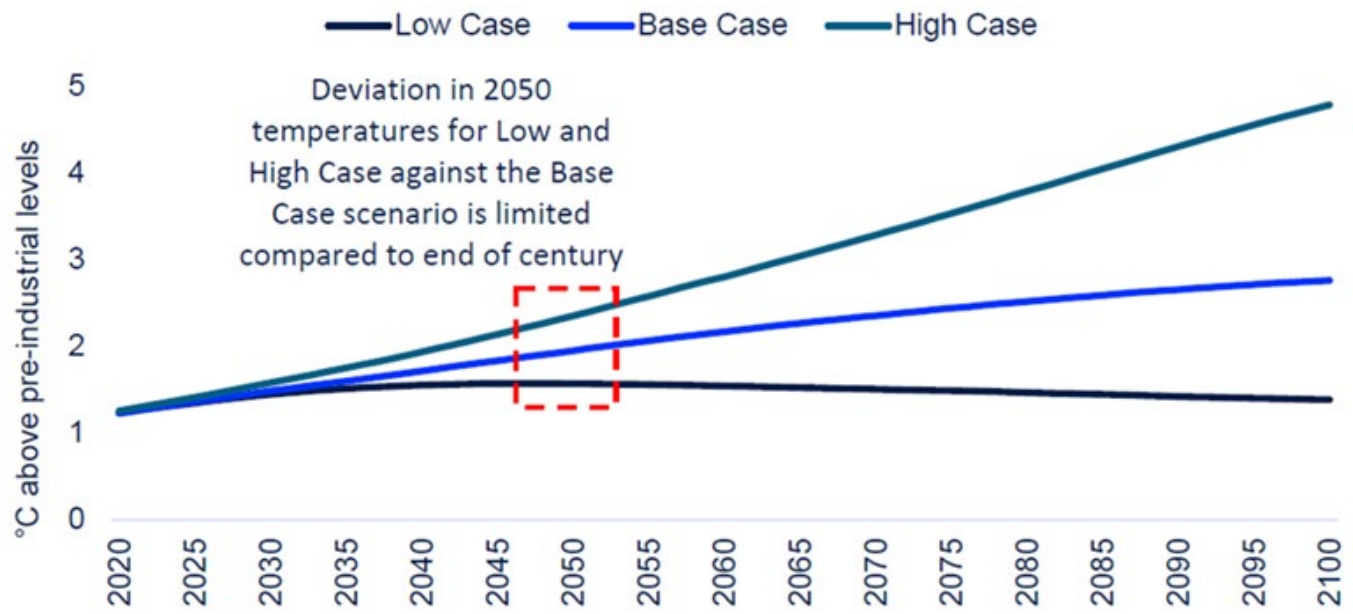
The pathway for temperature change is uncertain

Figure 4: Global warming pathways in climate change scenarios



Source: GIC Sustainability Office analysis, Bain & Company, IPCC

- **The direction and pace of travel for climate change is uncertain. Divergence doesn't happen for another ten years.**
- **This makes it difficult to justify climate investments in the short-term or consider the cascading impact of "tipping points."**
- **But as global warming continues and climate-related weather events increase in frequency and intensity, allocators must reshape portfolios for the future.**

Source: Sizing the Inevitable Investment Opportunity: Climate Adaptation, GIC, Bain

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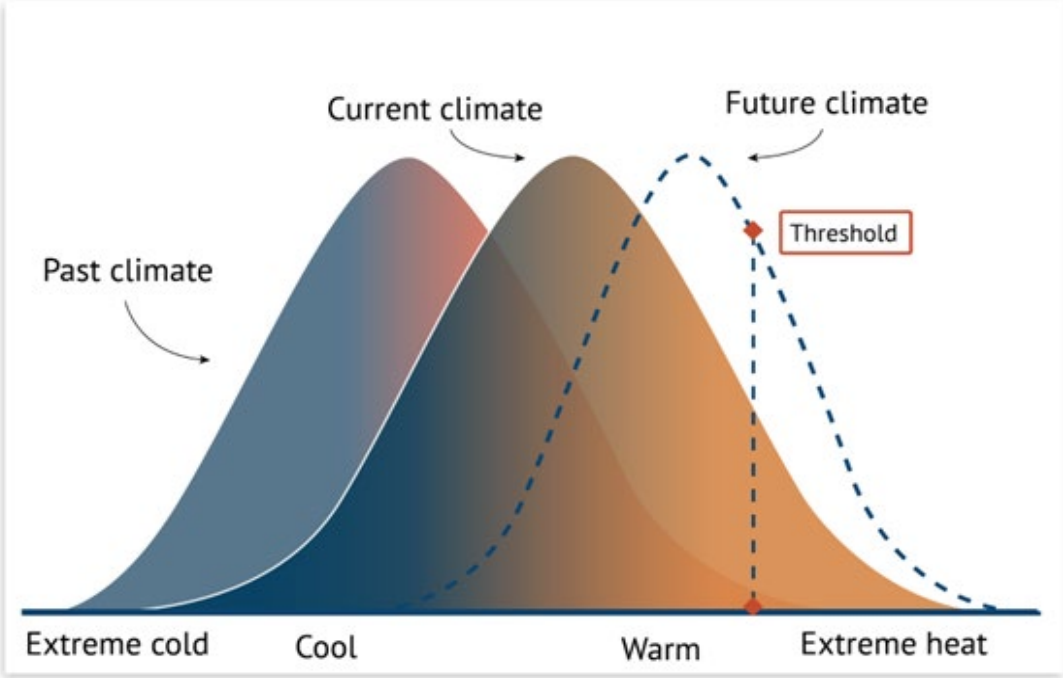
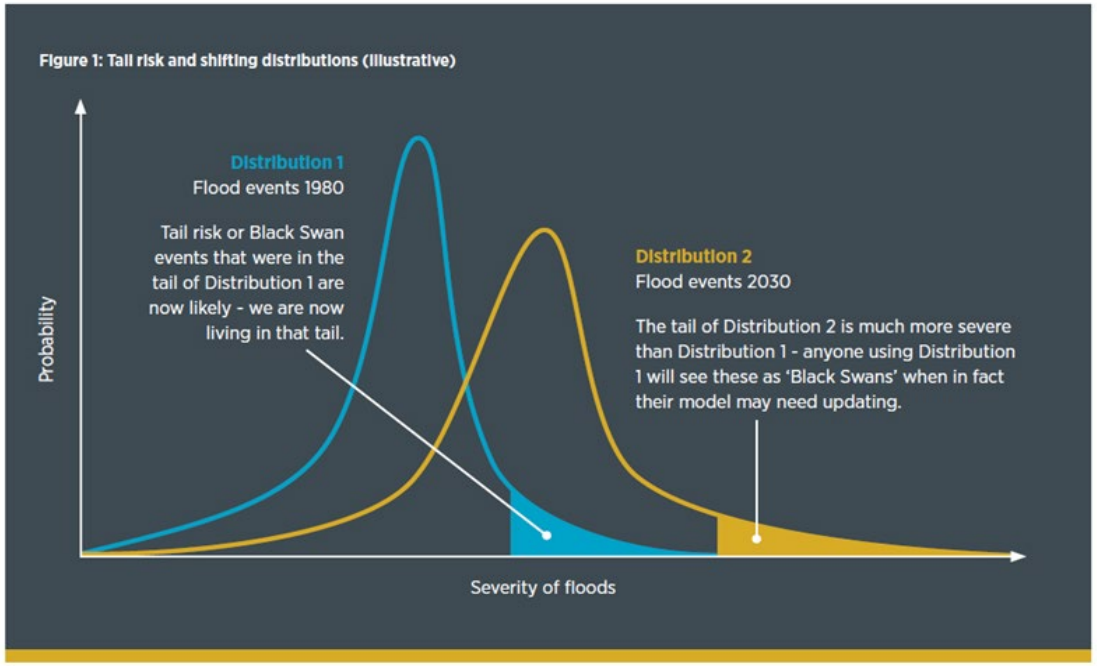
The Bell curve of probable climate events is shifting

The probability of severe weather events grows faster than for less extreme events as temperatures rise and the distribution of probable outcomes (bell curve) shifts to the right.



Tandon, Ayesha. *Q&A: The Evolving Science of "Extreme Weather Attribution,"* Nov 18, 2024, Carbon Brief

Yesterday's fat tails are today's high probability events. Today's fat tails are yesterday's black swans. The impacts may be uncertain, but we must plan for extreme climate risks in portfolios.



Source: Climate Scorpion: the Sting is in the Tail, Institute and Faculty of Actuaries (IFOA)

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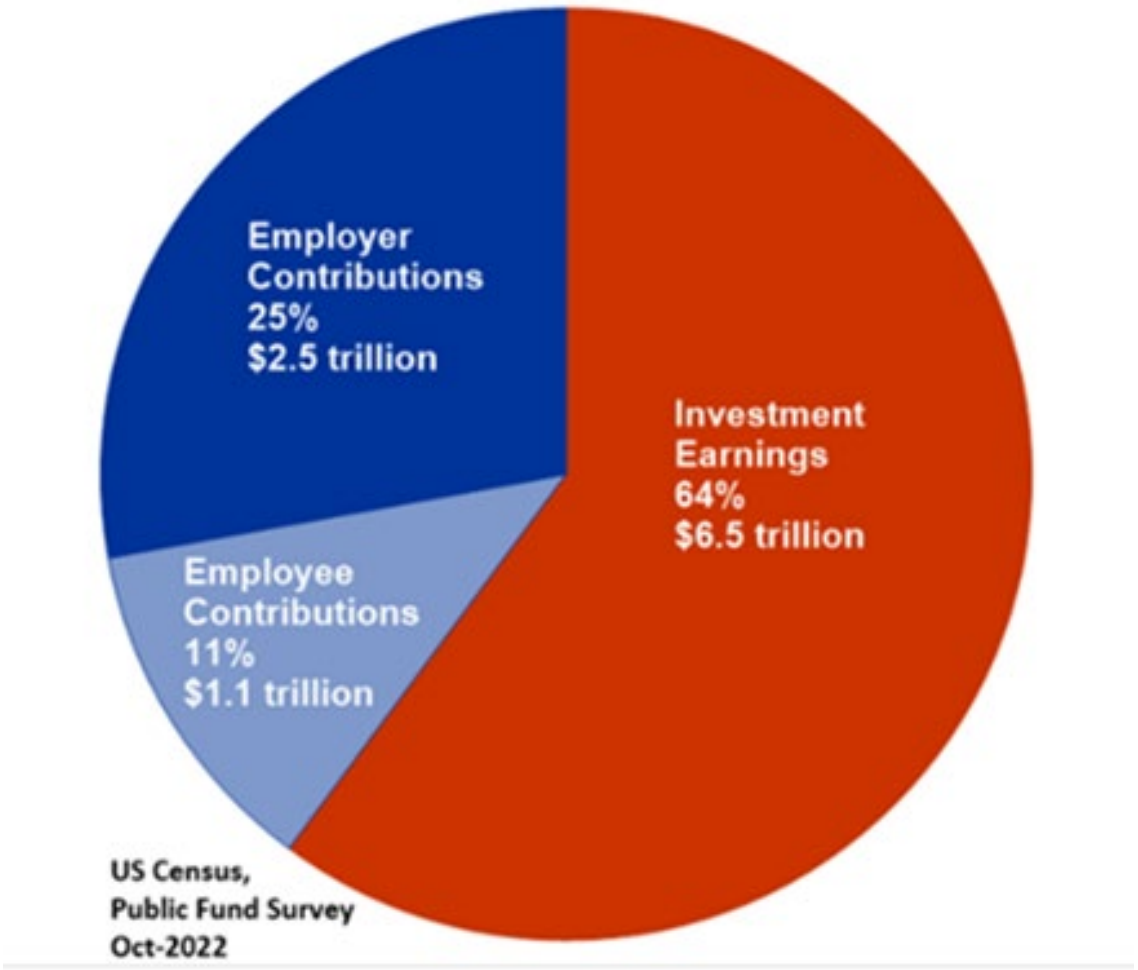
Climate risk could threaten pension payouts



- Over 60% of pension payouts come from investment returns.
- If returns for pension funds are lower than forecast because of climate impacts, pensions could face shortfall risk – the risk of not being able to meet payout obligations.
- Policy makers should take steps to prevent lower-than-expected returns for pension funds that could reduce funding ratios and require greater contributions to keep them solvent.

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The Responsible Asset Allocator Initiative at the Fletcher School

Please consider becoming a member of the RAAI. Support our work.

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