In Focus

Who's holding the risk?

How natural catastrophe risk modelling is evolving and distributed across the financial system

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Key takeaways

1. **Natural hazard risk is a systemic, macroeconomic issue, not just an insurance issue.** As insured losses rise and insurance capacity becomes more constrained, risk is redistributed across households, lenders, capital markets, institutional investors and governments, creating new transmission channels and investment considerations.

2. **Understanding the risk model – and how it is used – is as important as understanding the asset.** Catastrophe models are essential tools for pricing and allocating capital, but like all models they have limitations, and are evolving to catch up with a rapidly changing set of risks. As such, investors need to evaluate how managers interpret model outputs and manage tail risks, rather than relying on modelled scores alone.

3. **Risk transfer creates attractive investment opportunities where capital is priced appropriately.** Insurance-linked securities, securitisation and other risk-transfer markets can offer attractive returns by absorbing catastrophe risk when pricing reflects expected losses and required margin, while at the same time helping to improve the resilience of the wider financial system.

4. **Adaptation and resilience represent a growing structural investment theme.** Beyond transferring risk, investors can access opportunities to invest in infrastructure and real estate strategies that are enabling more resilient real assets, as well as into private equity strategies that are supporting the development or expansion of adaptation technologies and services. These help reduce vulnerability while supporting long-term value creation.

5. **Competitive advantage will increasingly come from superior risk management.** As natural hazard risks evolve, successful investors will combine robust modelling with expert judgement, proprietary analysis and active portfolio management to identify opportunities, manage downside risk and allocate capital more effectively. We increasingly observe large institutional investors adopting a total portfolio perspective when assessing long-term structural trends, rather than viewing natural hazard risk through the lens of a single asset class.

This note focuses on natural catastrophe risk, primarily in the context of asset-backed finance and property (re)insurance. In other words, the acute impact of large-scale events on physical property. That is distinct from other physical climate risks, such as chronic sea-level rise, heat stress or long-term precipitation shifts affecting agriculture.

Natural catastrophes are local in occurrence, but they can become systemic in financial effect. A key distinction is that between trends in the number of events and trends in losses. The scientific evidence for changes in frequency or intensity varies by peril and region. Insured losses, by contrast, have increased structurally. The main drivers are exposure growth, greater concentration of assets and people in hazard-prone areas, and higher reconstruction costs driven by inflation. Put simply, the volume of exposure has expanded.

In this context, insurance markets often act as early indicators: rising premiums, higher deductibles and capacity adjustments reflect updated model outputs,

Schroders capital

capital requirements and changing perceptions of risk. In some regions, capacity has declined materially.

When insurance becomes unaffordable or unavailable, the risk does not vanish – it shifts. It remains with property owners, lenders or, ultimately, the state. Insurance markets often function as an early warning system, reflecting risk more quickly than credit markets or property valuations. Natural hazards are therefore no longer solely an insurance issue; they increasingly shape lending, investment and regulatory considerations.

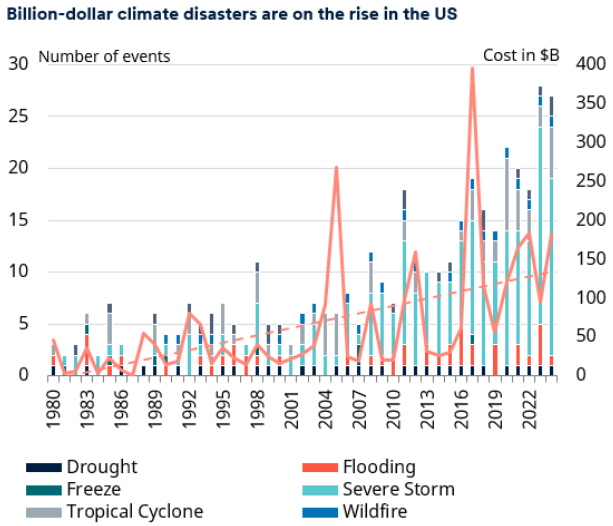
The sections that follow focus on short- to medium-term extreme weather events and on their modelling, pricing and capital allocation. Longer-term climate developments remain highly relevant, but the materialisation of physical losses is central to immediate capital allocation and risk transfer. We plan to explore longer term climatic change in additional future pieces.

PART 1: THE LANDSCAPE FOR MODELLING NATURAL HAZARD RISK

Increasing loss trends: key drivers – and implications for risk modelling

Economic exposure has increased: there are more assets and individuals in coastal regions and other exposed areas, and higher construction costs driven by labour and material inflation. As a result, the financial impact of individual events is simply greater today than it was some decades ago. Climate-induced hazard changes amplify that trend.

Physical climate risks are not new; they are embedded in real assets and therefore are present in every corporate balance sheet. What has changed in recent years is the loss trend.



Source: National Center for Environmental Information, 2025.

The discussion often focuses on whether exposure or hazard changes are the main driver, or whether it is the frequency or intensity of hazards that is increasing. Scientific evidence shows that the intensity of most atmospheric perils has – and will continue to – increase as more energy is available in a warmer world. Frequency changes, however, are harder to predict, and models diverge.

This highlights a key point that is often missed. The insurance market can model inflation and growth effects with confidence and cope with resulting cost pressures; it has done so for decades. Modelling climate-induced hazard changes is more uncertain, and how the market deals with this added climate variability increasingly shapes long-term insurance availability and pricing.

Resilience measures – such as stricter building codes, property-level measures, often supported by premium incentives, and public infrastructure such as flood defences or levees – can meaningfully reduce losses. Their effect on pricing, however, is slower.

Loss experience and model updates must recognise those improvements first. They also create new questions, particularly where protection systems fail and losses amplify non-linearly once thresholds are breached. Insurance markets typically react first: premiums rise, deductibles increase, and in certain regions capacity partially or fully withdraws. This is not alarmism; it is price discovery under stress.

Once insurance becomes unaffordable or unavailable, the issue changes character. Property owners retain more risk directly, banks bear indirect collateral risk through mortgages or business loans, and the state becomes an implicit reinsurer of last resort. This is where the systemic perspective begins. An extreme event can destroy local income bases, push firms into insolvency and, through payment arrears and write-downs in credit portfolios, raise questions of liquidity and financial stability.

Climate as a systemic risk touches on aspects such as contagion, macroeconomic shocks and unwinding of imbalances.

1. **Contagion** – interdependencies that cause cascading impacts within the financial system and the wider economy, for example a reduction in property values in areas deemed high risk impacting across households, banks, insurers, local infrastructure services and mortgage securities.

2. **Macroeconomic shocks** – supply shocks that disrupt critical delivery chains, impacting macroeconomic variables such as food or energy

supply chains.

3. **Unwinding of imbalances** – markets having mispriced climate exposures, leading to overvaluation of assets, underpriced insurance, can trigger abrupt repricing and balance-sheet losses.

The question of who ultimately bears the risk is therefore relevant not only from a finite balance-sheet perspective, but a systemic, macroeconomic one as well.

Physical risk modelling: are we speaking about the same thing?

In a changing climate, natural hazards can no longer be modelled credibly using historical loss experience alone. Extreme events are rare, non-linear and characterised by pronounced heavy-tail behaviour. Trend corrections and extrapolations can help, but they may fall short in the tail. Physics-based approaches are more robust because they incorporate non-linear effects and the possibility of jumps, thresholds or tipping points.

Modern catastrophe models work with stochastic event sets. Using data-driven or physics-based approaches, they simulate thousands of synthetic years of activity to capture event frequency, intensity and correlation. These events are applied to detailed exposure data, vulnerability functions translate hazard intensity into damage, and financial modules account for contract structures such as deductibles and limits.

The result is a full loss distribution that explicitly quantifies uncertainty. This is the framework the insurance industry has used for decades to price risk adequately and allocate capital efficiently.

Elsewhere in the financial system, the broader term 'physical climate risk' is more common, split between acute and chronic risks. Acute risks, similar to the term natural catastrophe, examines short-term extreme weather events, whereas chronic risks are related to long-term changes in climate patterns, for example sea level rise and precipitation patterns.

As the financial system continues to be regulated across many regions with respect to climate risk, and given increased desire to measure such risk accurately, an emerging suite of models in this space has occurred over the past five years – and notably the past two years.

New tools promise location-level risk assessment and forward-looking trend information across different climate scenarios and perils. A recent GARP benchmarking study of 13 model vendors found wide dispersion not only in hazard estimates, but also in the associated damage estimates. In some cases, one model identified a property as highly exposed while another indicated little or no exposure.

That does not invalidate these tools, but it does suggest that risk scores can sometimes convey a stronger sense of precision than the underlying uncertainty warrants. Supervisory authorities are increasingly paying attention to this broader issue of model governance, data quality and documentation.

What this means is that greater model complexity does not mean less uncertainty. On the contrary, the more closely one looks, the clearer assumptions and limitations become. For example, many tools for investors examine climate risk through an exposure rating; a perfectly reasonable first step in assessing and prioritising investments that are more highly exposed. However, translating said exposure into accurate and actionably priced risk, requires more detailed analytics.

A key step towards more robust physical climate risk management across sectors is to align how risks are quantified and interpreted. Given the insurance industry's enabling role for other economic activities, that approach should be closer to the way insurance has assessed risk: probabilistically, distribution-based, and with explicit acknowledgement of uncertainty.

For investors, this means that one never invests only in an insurance product or a real asset, but also in a model, and in the manager's ability to apply that model as one of a number of decision inputs – and to analyse, understand and consistently manage tail risk.

Changing landscape: how natural catastrophe modelling is shifting

Recent political developments, particularly in the US, have raised questions around the continuity of certain publicly funded data sets. Examples include the partial reduction of ocean-based measurement systems and broader uncertainty around long-term environmental monitoring initiatives.

From a modelling perspective, it is important to put these developments into context. First, catastrophe models rely on long-term historical datasets and physical relationships, rather than short-term data flows. Temporary gaps in data collection – even over multiple years – are typically not material to model performance.

Second, data generation is not solely dependent on US public institutions. A growing ecosystem of private providers, European academic institutions and decentralised expert networks continues to contribute to critical datasets.

Third, the current environment may prove to be a catalyst for technological innovation in data collection and processing. Advances in satellite technology, remote sensing and AI-driven data reconstruction are rapidly expanding the ability to observe and model physical

risks, in some cases reducing reliance on individual ground-based measurement systems.
Finally, the long-term trajectory remains uncertain and will depend on future political decisions. A reversal or reinstatement of US public data infrastructure is entirely plausible, particularly given the increasing relevance of climate risk for financial stability and economic resilience.

Overall, while these developments highlight the importance of robust and diversified data sources, they do not fundamentally undermine the integrity of catastrophe modelling frameworks today. Rather, they reinforce the need for continuous validation, multiple data inputs, and ongoing model evolution. Better data enables more effective risk transfer. As transactions expand into new regions and perils, they not only increase demand for robust data and modelling but also generate new exposure, hazard and loss data, strengthening the wider ecosystem.

Policy shifts are continually changing in a time where the physical risk landscape is becoming more complex with the increasing frequency and severity of extreme weather events. Overall, the expectation is that when major events occur in the future, renewed interest and investment in forecasting and data infrastructure will arise, potentially reversing the current trajectory.

Arguably changes in public-sector data provision, coupled with the growing complexity and prevalence of physical risks creates a stronger case for innovation in catastrophe modelling. One clear opportunity lies in the expansion of private data ecosystem and alternative proprietary data – for example, satellite imaging, sensor networks, geospatial datasets. There are numerous areas of innovation that are growing, across the likes of machine learning, hybrid and scenario-based modelling.

PART 2: NATURAL HAZARD RISK IN THE FINANCIAL SYSTEM

Risk dissemination, optionality and price elasticity

Different layers of the financial system operate under different capital requirements, regulatory regimes and return expectations. Risk transfer is therefore highly price dependent. When expected loss plus an uncertainty margin is adequately compensated, capital flows. When it is not, capital withdraws. That is not market failure; it is market mechanics.

Natural catastrophe risk never remains local. It moves through the insurance system and into the wider financial market.

At the first level are households and companies, which bear deductibles and uninsured losses. Primary insurers assume part of the risk and pass peak exposures on to reinsurers. Reinsurers, in turn, transfer part of their tail risk into capital markets – for example via insurance-linked securities (ILS). Banks and investors are indirectly exposed through mortgages, project finance and infrastructure. And when risk transfer no longer works, society takes on the residual risk as part of the loss is absorbed through public mechanisms such as residual markets, rate regulation or subsidisation.

This is where price elasticity matters. Fully collateralised alternative risk capital – such as ILS – is typically highly price-sensitive. Reinsurers are also return driven, but often react with a longer time horizon and in the context of strategic client relationships. Primary insurers face regulatory constraints and requirements. Banks usually react with delay, not least because their risk logic has traditionally been more credit-focused and physical risks tend to affect them indirectly through collateral and cash-flow channels. States are generally the least elastic participants.

When insurance capacity contracts, implicit exposure rises among less flexible actors. This rarely happens abruptly; more often it occurs gradually until a large event tests the structure and begins to destabilise it – for example through acute liquidity needs, defaults or public intervention to preserve financial stability. Heightened supervisory expectations reflect this reality: physical risks are now expected to be embedded across governance and capital planning.

The central question is therefore not whether risk is distributed, but how stable that distribution remains when tail events occur and capital mechanisms come under stress at the same time. Price elasticity across financial market participants shapes how natural hazard risk is transmitted and amplified.

Beyond insurance: wider financial market implications

There is increasing interest in what natural hazard risk means for the health of the housing finance system, notably in the US. For example, a recent FT article explored the climate shocks that could trigger the next financial crisis.

At a direct level, disasters reduce household income, either through repair costs or increased insurance premiums. They also disrupt business operations and damage property, increasing the likelihood of loan defaults and tighter credit conditions, higher borrowing costs and reduced investment.

Mortgage and real estate markets are a particularly important transmission channel because residential and commercial properties underpin a large share of bank lending and mortgage-backed securities (MBS). Natural hazards can reduce property values through physical damage, repeated losses or rising insurance costs, eroding the collateral to support mortgage loans.

Generally, the housing finance system treats natural disaster risk as a shared burden rather than a cost borne strictly by individual banks, borrowers or investors. If a property is damaged or destroyed, there are usually insurance mechanisms to finance repairs and reconstruction, as well as fees and guarantees to pay back lenders in case of default.

Reduced insurance availability increases the financial vulnerability of households and businesses. It also raises credit risk for lenders, as uninsured losses make borrowers less able to service debt. This can depress property values and reduce investor confidence, creating feedback loops between insurance markets, credit markets and real estate prices.

While transfer mechanisms such as securitisation and insurance-linked securities broaden the pool of capital available to absorb losses from extreme weather events – reducing concentration risk within individual institutions – this also means investors across global fixed income or alternative asset classes become more exposed. Many of these asset classes are widely held by asset managers and, in turn, pension funds, insurers and central banks. Generally, physical climate risk is largely disseminated, however, the increase of frequency and severity of natural hazards could increase concentration across a market player's exposure.

Beyond householders and the housing system, extreme weather events can affect the value and performance of other financial assets. At a direct level, failure of critical infrastructure – including transport networks, power systems, telecommunications and water infrastructure – disrupts economic activity, increasing the likelihood of loan defaults and weakened balance sheets.

Infrastructure assets, which are financed through a wide range of capital market instruments, add further transmission channels to the wider financial system – project finance loans, infrastructure debt, private credit, asset-backed securities and listed infrastructure funds. Damage to critical infrastructure can reduce operating revenues, increase maintenance costs and impair asset values, affecting both debt servicing and reducing corporate earnings across multiple sectors simultaneously.

Given infrastructure underpins the functioning of the broader economy, its disruption amplifies the transmissions of natural hazard risk through banks, capital markets, sovereign finances and institutional investment portfolios. The concept of cascading failures is emphasised within research, demonstrating natural hazard risk is not confined to one asset class, but propagates through multiple interconnected segments of the financial system.

The challenge becomes how to assess such exposure; modelling natural hazard risk will require moving beyond assessments of individual asset classes towards a system-wide perspective that captures the interconnected exposures and feedback mechanisms across the financial system. Interdependencies create nonlinear and potentially amplifying effects that cannot be captured through siloed analysis alone.

A structural challenge is the potential gap between insured exposures and available insurance capacity. Over the past decade, the value of insurable assets (particularly real estate) has increased substantially due to rising property prices, reconstruction costs and continued development in hazard-prone regions. In the US, for example, a simplistic comparison between 2014 and 2024 shows the property and casualty insurance sector has struggled to keep pace with the combined increase of higher insured values, rising replacement costs and increasing natural hazard frequency and severity.

Measure	Start	2024	Growth
U.S. owner-occupied real estate market value	$20.6T in 2014 Q4	$45.0T in 2024 Q4	**+118%**
U.S. P&C policyholders' surplus	$706B in 2015	$1.13T in 2024	**+60%**
U.S. P&C net premiums written	$524B in 2015	$935B in 2024	**+78%**
Residential reconstruction costs	Oct. 2014	Oct. 2024	**+63.7%**
Commercial reconstruction costs	Oct. 2014	Oct. 2024	**+58.4%**

Sources: FRED/Fed Z.1 for owner-occupied real estate values, NAIC for P&C surplus and premiums, Verisk for reconstruction costs.

This trend has implications for real estate and infrastructure investments and balance sheets of corporates based on the availability of insurance.

The growing imbalance also creates significant opportunities for ILS and broader capital markets to absorb catastrophe risk. However, it also highlights that the adaptation opportunity is not just about financing risk-bearing capacity, but also financing resilience/adaptation improvements and solutions.

Adaptation and resilience as an investment theme

As natural hazard risk intensifies, capital markets are increasingly recognised not only as a mechanism for absorbing financial losses, but also as a source of financing for adaptation and resiliency.

Historically, financial markets have focused on transferring catastrophe risk through insurance, reinsurance and securitisation. However, the growing impact of natural hazards, are driving demand for investments that reduce vulnerability before disasters occur. This reflects a broader recognition that resilience can enhance long-term asset performance by protecting cashflows, preserving value and reducing the likelihood of financial losses.

Adaptation and resilience present opportunities for institutional investments. These opportunities can largely be categorised into three aspects:

1. **Risk transfer and dissemination:** focusing on redistributing the materialisation of natural hazards rather than a reduction in the underlying risk; spreading losses across a broader pool of investors and improving the capacity of the overall system to absorb stocks. Examples include insurance-linked securities and securitised products such as mortgage-backed securities.

2. **Asset-level adaptation and resilience:** reducing the vulnerability of existing assets to natural hazards. These measures enhance the resilience of real estate, infrastructure and corporate assets by reducing damage, improving operational continuity and preserve cash flow, while also encourage lower insurance costs and improved credit quality.

3. **Direct adaptation and resilience opportunities:** investments in products, services and technologies that enable adaptation across the wider economy. This could include nature-based solutions, resilient construction materials and water management technologies. These investments largely have revenues directly linked to the increasing demand for climate adaptation and/or resilience.

These categories are complementary layers of a natural hazard risk management strategy. But financial markets alone cannot determine the optimal adaptation outcome. Local authority planning and governance are best to determine what is the most effective.

For example, a recent New York Times piece highlighted the wasted opportunity to rebuild effectively in New Orleans following Hurricane Katrina. The limited investment in better infrastructure, rather than replacing inadequate like-for-like infrastructure, came with a price tag of $140 billion. In this scenario, risk transfer and dissemination assisted in restoring financial losses, but did not contribute to reducing future vulnerability. System- and asset-level resilience efforts could have raised the resilience standards of both individual assets, as well as the location overall for future natural hazard events.

Capital markets can mobilise capital and distribute risk, but system-level resilience will rely on complementary public policy and planning to reduce both the financial and physical consequences of natural hazards.

PART 3: OUR INVESTOR TOOLKIT

Understanding how natural hazard risk propagates through the financial system is only the first step. For investors, the more relevant question is how these developments can be reflected in portfolio construction and capital allocation decisions.

We increasingly observe large institutional investors adopting a total portfolio perspective when assessing long-term structural trends. Rather than viewing natural hazard risk through the lens of a single asset class, the focus is shifting towards understanding how risks and opportunities interact across the broader portfolio.

In this context, there is no single implementation solution. Different investors will have different objectives, constraints and risk-return requirements. The role of an investment manager is therefore not only to identify emerging developments and risks, but also to help investors evaluate potential responses and implementation pathways.

The following sections outline several examples of how investors, based on our own toolkit of asset classes and strategies, may respond to increasing natural hazard risks across different parts of their portfolio.

Insurance-linked securities (ILS)

As outlined in the sections above, natural hazards begin in the physical world. Homes, infrastructure and industrial facilities are affected first. In theory, that risk can be transferred through insurers, reinsurers and, increasingly, capital markets. In practice, however, risk transfer is never unconditional. It depends on price, capital availability and regulatory frameworks.

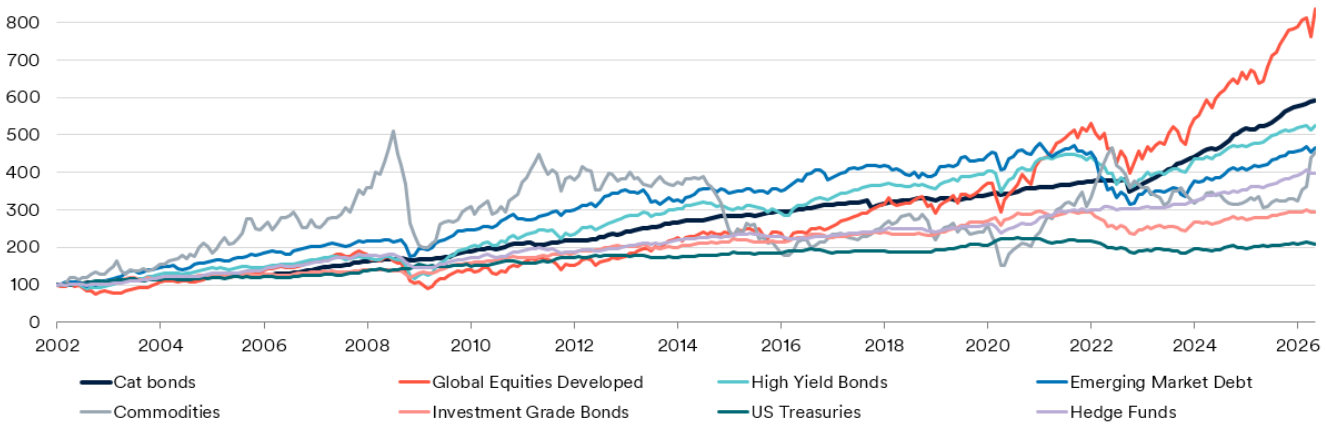
Natural catastrophe risk is never eliminated by insurance; it is transferred, priced and redistributed across the financial system. When coverage becomes less available or less affordable, the risk simply moves and the key question becomes who is left holding it when the cycle turns?

ILS are a clearly defined mechanism for transferring natural catastrophe risk into capital markets, providing reinsurance capacity in a fully collateralised and structurally transparent manner. Triggers and payout conditions are contractually defined, and the maximum loss is limited by the collateral posted. Expected loss, tail

ILS diversification benefits persist through market volatility

Low correlation of ILS to all major financial assets

Past performance is not a guide to future performance and may not be repeated. The value of investments and the income from them may go down as well as up and investors may not get back the amounts originally invested.



Source: Schroders Capital, Bloomberg, monthly returns from 1 January 2002 to 30 April 2026 in USD. Cat bonds: Swiss Re Global Cat Bond TR Index, Global Equities Developed: MSCI World, High yield bonds: BofA Merrill Lynch Global High Yield Index, Emerging Markets Debt: JP Morgan EMBI+, Commodities: S&P GSCI, Investment grade bonds: Bloomberg US Corporate Bond Index, US Treasuries: BofA Merrill Lynch US Treasury, Hedge Funds: HedgeIndex Main Index. Any reference to sectors/countries/stocks/securities are for illustrative purposes only and not a recommendation to buy or sell any financial instrument/securities or adopt any investment strategy. Our Funds invest in insurance-linked instruments which are particularly exposed to sudden substantial or total loss due to, natural and/or man-made catastrophes. Diversification cannot ensure profits or protect against loss of principal.

risk and diversification effects determine the spread required by investors.

Capital allocation in the ILS market is strongly model-driven. When expected loss rises or uncertainty increases, spreads typically rise as well. The system reacts comparatively quickly, and the market reflects new information on natural hazards, exposure or modelling assumptions directly through pricing. When an event occurs, predefined triggers apply; capital may be paid out or temporarily trapped until loss development is sufficiently clear; spreads adjust, and new issuance is placed on updated terms. The mechanism itself is technically clear, even if market dynamics can become complex, particularly during phases of clustered events and heightened uncertainty.

ILS can play a stabilising role because they provide additional capacity when the price is right. At the same time, the capital is sufficiently opportunistic to withdraw when risk-return relationships no longer fit. By providing capital for peak risk and supporting efficient price discovery, ILS improves the resilience of the reinsurance risk transfer chain.

For institutional investors, ILS offer access to an attractive risk premium, typically with low correlation to traditional financial markets and business cycles. They are not, however, a risk-free haven. Investors assume natural catastrophe risk – including model limitations, parameter risk and tail exposure. That is precisely why the quality of models, data and risk management is central to this asset class.

From our perspective, a significant share of value is created where a robust own view of risk is genuinely applied and used to inform portfolio construction: through consistent interpretation of models, including sensitivities and tail analysis, selecting optimal investment structures, and ongoing monitoring of the key parameters. That is essential if the risk-return profile is to be managed transparently in an environment of evolving models and changing climate signals.

Securitisation

Securitisation and asset-based finance (ABF) help manage natural hazard risk by redistributing, diversifying, financing and pricing risk across a broader set of investors, rather than leaving it concentrated on banks, insurers, households or governments. The asset class does not remove the underlying hazard, but it can improve the system's capacity to absorb shocks and fund resilience.

One of the clearest examples of securitisation spreading concentrated catastrophe risk is the insurance-linked securities market, as mentioned previously. The key aspect of securitisation is the distribution of risk.

Mortgage-backed securities are another key channel through which natural hazard risk can both spread through, and potentially be managed within, the financial system. Residential property sits at the intersection of physical climate exposure, household wealth, bank lending, insurance and capital markets. Mortgages are typically securitised, meaning hazard risk propagates far beyond the original lender.

An MBS is backed by cashflows from pools of mortgages. Natural hazards can impact MBS in a series of ways:

1. Borrowers' ability to repay through the likes of property destruction, job loss, displacement, uninsured losses and rising insurance premiums.
2. Underlying property value falls, changing the credit performance.
3. Withdrawal of insurance, either through an increase in premiums or exit entirely, affecting mortgage origination pipelines and securitisation volumes.

Without securitisation, local banks would hold most exposure. With MBS, risk is distributed globally across investors. This in turn diversifies and reduces local concentration and therefore can be viewed as a resilience mechanism.

In the US especially, mortgage risk is transferred into government agencies (Fannie Mae, Freddie Mac, and Ginnie Mae[1]), meaning the government-sponsored system indirectly absorbs large amounts of climate and natural hazard exposure, beyond that covered by required homeowner insurance. This stabilises mortgage funding during stress periods but would increase public exposure. Since 2007, the proportion of loan quantum by GSEs/GNMA increased from 30% to 48%, with a notable increase in the proportion of smaller lenders.

For GSE-backed mortgages, once a loan is sold to, or securitised by the GSE, the originating lender is shielded from credit risk. The GSE assumes that risk in exchange for a guarantee fee paid by the lender. These guarantee fees are generally uniform nationwide, meaning that local natural disaster risks are not explicitly reflected in the pricing of mortgage products.

In the case of mortgages purchased or guaranteed by GNMA, lenders may face liquidity pressures in the event of widespread defaults, since they must continue advancing payments to investors while awaiting reimbursement from federal agencies. However, investors in GNMA MBS are protected against borrower defaults by GNMA's guarantee, which is backed by the "full faith and credit" of the US government. These protections are not specific to natural hazard risks, but form a core part of the broader housing finance system.

For institutional investors, mortgage-backed securities and asset-based finance markets provide efficient access to diversified pools of real economy assets that would otherwise be too difficult to originate or manage directly. By pooling mortgages, infrastructure loans and the like into investible securities, these markets offer exposure to large, geographically diversified portfolios with predictable income streams. Securitisation facilitates the dissemination of risk across a broad investor base and reduce the concentration of exposure, limiting direct balance sheet exposure by transferring credit risk to government agencies and other non-affiliated institutions.

ABF and MBS investors can also shift from being passive holders of physical risk to active financiers of resilience. Future securitisation markets could increasingly reward investments that demonstrate reduced physical vulnerability and improved long-term performance, but this requires the development of robust standards and a mechanism for measuring and verifying resilience outcomes.

Increasing real estate and infrastructure resilience

Real estate and infrastructure are increasingly exposed to natural hazards, requiring emphasis on enhancing the resilience of physical assets to reduce potential losses, preserve long-term value and maintain stable income streams. Unlike financial risk transfer mechanisms that redistribute losses after an event occurs, investments in resilience seek to reduce the underlying vulnerability of assets.

For real estate, resilience investments focus on future proofing buildings by improving their ability to withstand and recover from natural hazards while maintaining functionality and market value. Adaptation measures include asset modifications, while resilience also incorporates measures for business continuity, such as back-up power during extreme weather events.

Infrastructure assets present the same components, but cascade impacts more thoroughly throughout the wider economy, increasing financial losses, particularly in the context of critical infrastructure. Investments in resilient infrastructure not only benefit the individual asset, but improve the resilience the broader economic system, even the aforementioned real estate market through the continued supply of water, energy and transportation access to properties.

Insurance plays a critical role in real estate and infrastructure resilience; acting as both a signal of physical risk and an enabler of investment. As insurers increasingly differentiate premiums according to property-level risk, resilient buildings may also benefit from improved insurability and lower long-term insurance costs, enhancing their attractiveness to both owners and investors.

These insurance signals have the potential to influence investment decisions, both by rewarding assets that demonstrate reduced expected losses through lower premiums, improved coverage terms or greater insurance capacity, and signal where continued investment may become economically unsustainable. Persistent increases in insurance premiums or withdrawal of coverage can indicate the exceeding of acceptable thresholds.

It's important to recognise the structural mismatch between the long-term investment horizon of real estate and infrastructure owners and the annual repricing cycle

[1] Note: Ginnie Mae (GNMA) is a government agency that guarantees mortgage-backed securities with the full faith and credit of the US government, while the GSEs (Fannie Mae and Freddie Mac) are government-sponsored enterprises that buy, securitise, and guarantee mortgages for a lender fee.

of insurance markets. Because insurance coverage and risk-transfer costs are generally reset each year, pricing secured at acquisition provides limited certainty over the life of an investment. This disconnect introduces an additional layer of uncertainty that can influence underwriting assumptions, asset valuations, financing capacity, and the long-term availability of capital.

Despite the growing investment opportunity, several challenges remain. Quantifying the financial benefits of resilience is more difficult than measuring the costs of adaptation. The complexity and quality of natural hazard data for asset managers, remains fragmented and the translation of physical hazard information into decision-useful investment metrics is a continual challenge. It requires estimates across impacted valuation, credit performance, insurance premiums and business continuity/cashflows .

Advocacy and engagement to strengthen building codes, energy-performance standards, and resilience-focused retrofit requirements can accelerate investment in the physical adaptation of the built environment. Although these requirements may necessitate near-term capital deployment and temporarily pressure returns – particularly for smaller owners or those operating with shorter investment horizons – they can materially reduce physical vulnerability, transition risk, and asset obsolescence over time. By establishing a more resilient baseline across the market, these policies can improve insurability, enhance investor confidence, better align stakeholder incentives, and support long-term asset value preservation.

For investors, the ability to accurately model natural hazard risk and assess the effectiveness of resilience measures represents a potential source of competitive advantage, better positioned to distinguish between assets that are fundamental exposed compared with those whose vulnerability has or could be materially reduced through adaptation measures. This enables more informed acquisition, valuation, asset management and exit, identifying assets with long-term value potential not fully recognised by the market and avoiding those that have the risk of standing or underperforming assets.

Private equity: adaptation and resilience Innovation

Beyond financing resilient real estate and infrastructure, investors can also access adaptation and resilience opportunities by investment in companies developing products, services and technologies required to manage increasing natural hazard risks. Demand is expected to grow for solutions that improve preparedness, reduce vulnerability and accelerate recovery.

This encompasses a breadth of opportunities, which won't be explored within this article alone. Private equity and venture capital markets are considered key to unlocking and catering for increased demand – where innovative companies are developing or scaling technologies, products or services. For the purpose of this paper, we focus on private equity's role in tackling the 'protection gap'; the difference between insured and uninsured losses, speaking directly to the interplay of adaptation and resilience solutions and risk transfer and dissemination.

The protection gap, reflecting the exposure of key market participants to uninsured losses, is structural, global and growing. Private equity can complement insurance mechanisms by mobilising capital to close the protection gap.

Private equity can address structural market failures in climate insurance, such as underdeveloped insurance ecosystems in emerging markets, where there is a lack of data, modelling and distribution, and affordability and accessibility constraints.

The opportunity sets can be both earlier stage/growth investments in climate adaptation technologies and data platforms, as well as scaling established platforms in insurance, insurtech and financial intermediaries. Whilst private equity focuses on risk origination, distribution and technology, it can complement the likes of insurance-linked securities, which acts more as a risk transfer capacity enablement.

Private equity investments sit at the intersection of growing climate-related losses and insurance protection gap, and private equity's search for operational alpha. In many cases, capital injections enable companies to offer new products, serve new client groups and/or invest in new technologies. This is complemented with management support to help with business strategy, product development and client education. This enables companies to overcome barriers to market penetration, such as low market awareness, negative perceptions of the value of climate insurance, and difficulties distributing insurance products to target groups. Through such investments, a multiplier effect is created.

Closer to risk dissemination: scaling established platforms in insurance, insurtech and financial intermediaries

For example, a fintech or digital services platform which integrates climate insurance solutions into their financial products, offering competitive cashflow financing alongside business insurance coverage to protect enterprises against natural disasters such as floods and earthquakes. Companies that operate at the intersection of financial inclusion, enabling technology and climate action facilitate access to financial services previously unavailable, incorporating insurance into lending products.

Other companies offer services through proprietary data and technology, for example providing agricultural insurance to smallholder farmers across emerging markets. A company can bundle insurance with essential products such as seeds and credit, increasing accessibility who lack formal insurance contracts or access to a viable insurance market.

This ultimately serves the market with a risk dissemination mechanism that enables a wider set of market players to have access and exposure to natural hazard events.

Technology and product innovation: establishing climate adaptation technologies and data platforms

As the topic of climate insurance and natural hazard risk expands, new scalable technologies will be required to apply to markets. The challenge is often no demand, but the cost and complexity of reaching large numbers of customers reliably, particularly in the context of emerging markets. Technology can reduce frictions in enrolment, underwriting, servicing, premium collection, event verification and payout.

Technology innovation can support in different ways depending on where it sits in the value chain. It can widen access by reducing customer acquisition and servicing costs, strengthen awareness when policy information and claims instructions are made more visible to clients and improve affordability when operating costs, price discovery, or catastrophe-risk measurement are improved. But Technology alone does not guarantee impact at scale. While digital and embedded models can expand access rapidly, they do not by themselves ensure that clients understand or use the product effectively. Technology delivers impact when it is embedded in a broader operating model that includes clear customer communication, reliable claims processes, and continued product refinement.

Further upstream players, such as climate-risk analytics, improve how catastrophe exposure is measured and managed by insurers, reinsurers, corporates and public actors. Better hazard intelligence can improve pricing, support more credible parametric structures, and strengthen the design of sovereign or public disaster-risk-finance mechanisms.

Private equity, and notably our examples here from emerging markets, provides institutional investors with access to segments of the adaptation and resilience economy that are often underrepresented or unavailable in public markets. Private equity represents an important investment channel for gaining exposure to businesses expected to benefit from increasing demand for climate adaptation and resilience.

Conclusion

Natural hazard risk is increasingly shaping capital allocation across financial markets. As insurance capacity becomes more selective and physical risks become more financially material, investors are likely to encounter these exposures across a growing range of asset classes. The opportunity is therefore not simply to avoid risk, but to understand how it is transferred, priced and rewarded.

This places greater emphasis on risk modelling. Models provide an essential framework for assessing expected losses and tail events, but they are not investment decisions in themselves. The quality of outcomes depends on how managers challenge assumptions, interpret and integrate model outputs into disciplined portfolio construction and ongoing risk management. Applying these capabilities is essential to inform high-quality asset selection, with the aim to avoid downside surprises and bad outcomes.

The increasing need for capital to absorb, finance and reduce natural hazard risk also creates compelling investment opportunities. From providing catastrophe risk capacity through insurance-linked securities and broader securitisation, to financing more resilient buildings and infrastructure, or investing into businesses developing adaptation solutions and services, investors can access structural sources of return while contributing to a more resilient financial system. Those best positioned to capture these opportunities are likely to be managers with deep expertise in natural hazard risk and sustainability, understanding of local market dynamics and needs, and a demonstrable ability to apply models thoughtfully, rather than simply rely on them.

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