

Rethinking **climate adaptation** for global resilience

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Strengthening climate adaptation for a resilient future

Executive Summary



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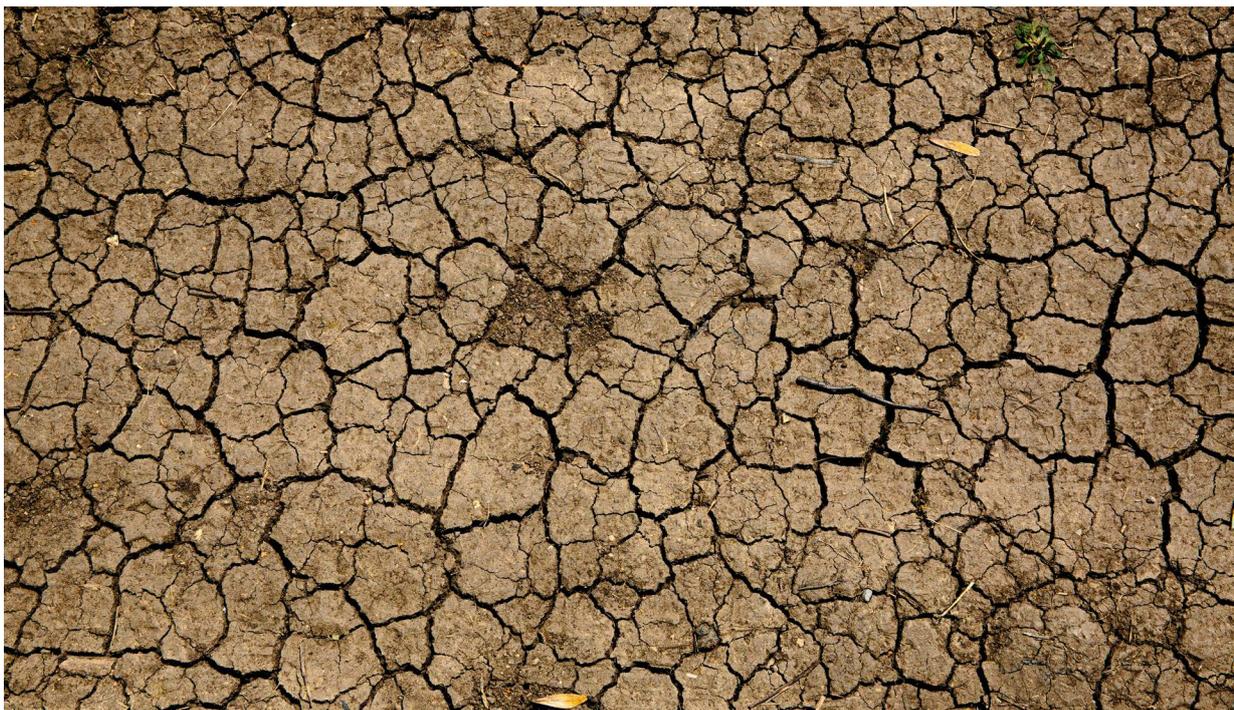
Reducing carbon emissions will not be enough on its own. According to newly released projections from the NGFS, even under a net-zero transition scenario, global GDP is expected to shrink by 8% compared to a baseline without climate change, an economic toll more severe than previously estimated. The latest estimates (Phase 5) show that the net-zero pathway would lead to an additional 6% GDP decline compared to Phase 4 projections, resulting in USD1.24trn in extra global economic losses by 2050. In Europe, for example, under the most ambition transition scenario, cumulative flood-related damages could reduce household disposable income by approximately USD107,000, with disproportionate effects across countries. Developing economies face a significantly higher toll from extreme weather events, both in human and economic terms. While 71% of reported disasters occurred in developed countries, 91% of fatalities were in developing nations due to weak infrastructure and limited early-warning systems. Least Developed Countries (LDCs) and Small Island Developing States (SIDS) have experienced severe financial devastation due to climate change, with some disasters wiping out over 100% of GDP. These losses underscore the growing risks of climate impacts and highlight the urgent need for adaptation measures alongside mitigation efforts.

Yet, adaptation finance remains severely underfunded. By 2030, the annual demand for adaptation funding is projected to reach USD387bn. But only USD63.5bn was mobilized as of 2022, leaving a massive USD323.5bn shortfall. This funding gap puts millions at greater risk of climate disasters. Furthermore, the limited adaptation finance available was distributed unevenly, revealing deep regional disparities in access to critical resources.

The insurance gap is also a critical challenge in climate adaptation, with developing economies facing particularly severe underinsurance. Countries like China and India have alarmingly high insurance gaps of 94% and 93%, respectively, leaving nearly all disaster-related economic losses uninsured. This is closely linked to their low insurance penetration rates (China: 1.2%; India: 0.6%). But while developed economies have much lower gaps, thanks to well-established insurance markets and financial safeguards, coverage fluctuates depending on disaster severity and preparedness.

In the face of escalating climate risks, the public sector holds a central role in advancing adaptation efforts, not only as a regulator and financier, but also as a catalyst for private sector engagement. By guiding infrastructure development, shaping urban planning and deploying targeted fiscal policies, governments can reduce climate vulnerability and foster long-term resilience. A critical strategy in this effort is the use of blended finance, which strategically combines concessional public funding with private capital to channel investment into adaptation projects that may be perceived as too risky or unprofitable. This approach enables public resources to de-risk investments, making them more attractive to institutional investors and unlocking essential financing for climate resilience initiatives.

Expanding insurance coverage is essential for enhancing climate resilience across both developed and developing economies, but strategies must be adapted to local conditions. In developed countries, national insurance schemes are key to managing climate-related risks by pooling exposures across various hazards and asset types, thus offering broad financial protection and promoting long-term stability. Government-backed insurance pools in particular help maintain access to coverage in areas where private insurers face difficulties in offering affordable policies for natural catastrophes. For instance, the US has established prominent public insurance mechanisms such as Florida's Citizens Property Insurance Corporation and the Florida Hurricane Catastrophe Fund for windstorm risks, as well as the California Earthquake Authority for seismic events. These programs illustrate the potential of publicly supported insurance to address challenges around affordability, risk concentration and financial sustainability in the face of growing climate threats.

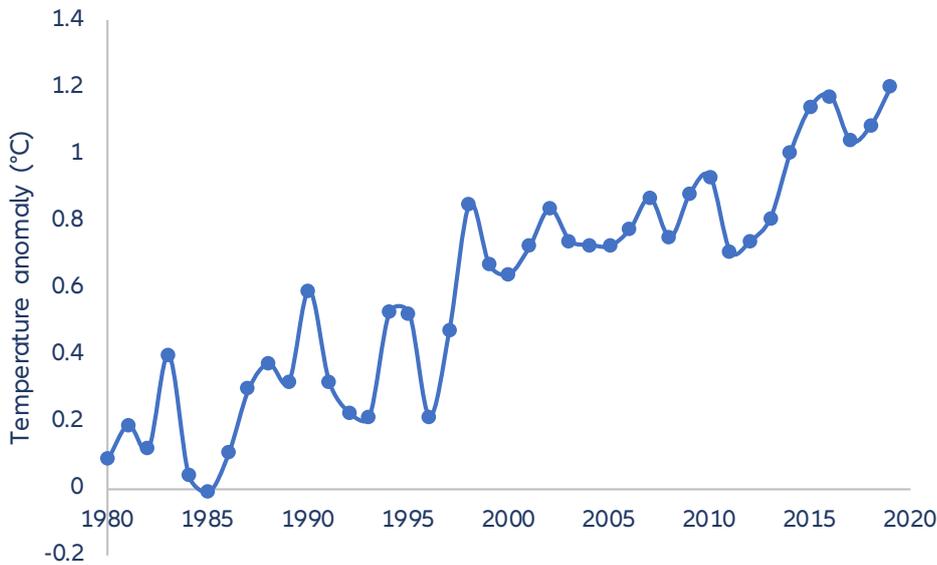


Weighing the costs of non-adaptation

Climate mitigation – i.e. cutting carbon emissions – will not be enough on its own. Human activities such as fossil-fuel combustion, deforestation and large-scale industrialization have significantly increased the concentration of greenhouse gases in the atmosphere, disrupting the planet's delicate climate balance. Historical climate data indicates that global temperatures have already risen by approximately 1.2°C compared to the 1950–1980 average (Figure 1). This warming trend has accelerated in recent decades, with the past few years consistently ranking among the hottest on record. Projections from the Intergovernmental Panel on Climate Change (IPCC) suggest that, depending on mitigation efforts, global temperatures could rise between 2°C and 4.5°C by the end of the century. Even under the highly ambitious 1.5°C warming limit by 2100, the cumulative economic losses from climate change are estimated to reach a staggering USD1,062trn between 2025 and 2100¹.

However, this pales in comparison to the catastrophic financial toll projected under a business-as-usual trajectory, which could result in USD2,328trn in climate-induced losses if global temperatures rise by 4.5°C. These figures highlight a stark reality: even the most optimistic transition towards a green economy, implemented in an orderly and globally coordinated manner, will not be sufficient to prevent severe economic repercussions without parallel investments in adaptation strategies to protect people, cities and economies from climate impacts. These range from building flood barriers and heat-resistant infrastructure to improving water management and disaster response. The urgency for governments, businesses and financial institutions to scale up both mitigation and adaptation efforts cannot be overstated. From infrastructure resilience to ecosystem restoration, climate adaptation must become an integral pillar of economic and policy planning to avert irreversible social and economic disruptions.

¹ [The Cost of Inaction - CPI](#)

Figure 1: Rising global surface temperature compared to average temperature 1950 - 1979

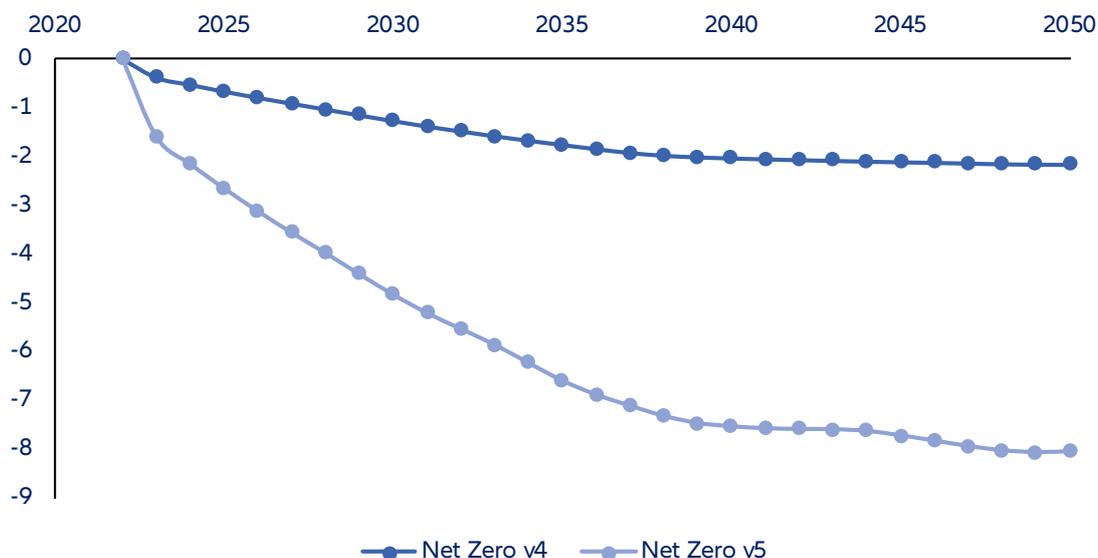
Sources: Copernicus, Allianz Research

In its recent conceptual note on adaptation, the Network for Greening the Financial System (NGFS) emphasizes the urgent need to prioritize investments in climate adaptation. Investments in climate resilience not only prevent future economic losses but also generate substantial socio-economic benefits, strengthening the adaptive capacity of vulnerable communities and advancing sustainable development. In early November 2024, the NGFS released updated projections (phase 5) on climate-related damages, incorporating a newly developed physical damage function. This cutting-edge methodology enhances the accuracy of assessing the external costs of physical climate risks by integrating regional variations, climate fluctuations and the long-term persistence of damages². The findings paint a sobering picture: even under a net-zero transition scenario, global GDP is expected to contract by approximately 8% compared to a baseline scenario without climate change, an economic toll

more severe than previously estimated. For context, the previous NGFS framework (2023, phase 4) projected a GDP decline of about 5% under the current policy trajectory. Additionally, under the phase 5 net-zero pathway, GDP declines by an additional 6% compared to the phase 4 NGFS net zero projections, translating into an estimated USD1.24trn in additional global economic losses by 2050 (Figure 2). These figures underscore a critical policy challenge. Even the most ambitious mitigation efforts, such as those targeting net-zero emissions, are insufficient to fully avert the economic consequences of climate change. The potential physical damages highlighted in these projections stress the need for parallel adaptation measures. By investing in adaptive strategies, such as resilient infrastructure, enhanced disaster preparedness and improved land-use planning, policymakers can significantly reduce these economic and social vulnerabilities.

² The economic commitment of climate change | Nature

Figure 2: GDP contraction under net-zero scenario: A comparative analysis of NGFS Versions 4 and 5

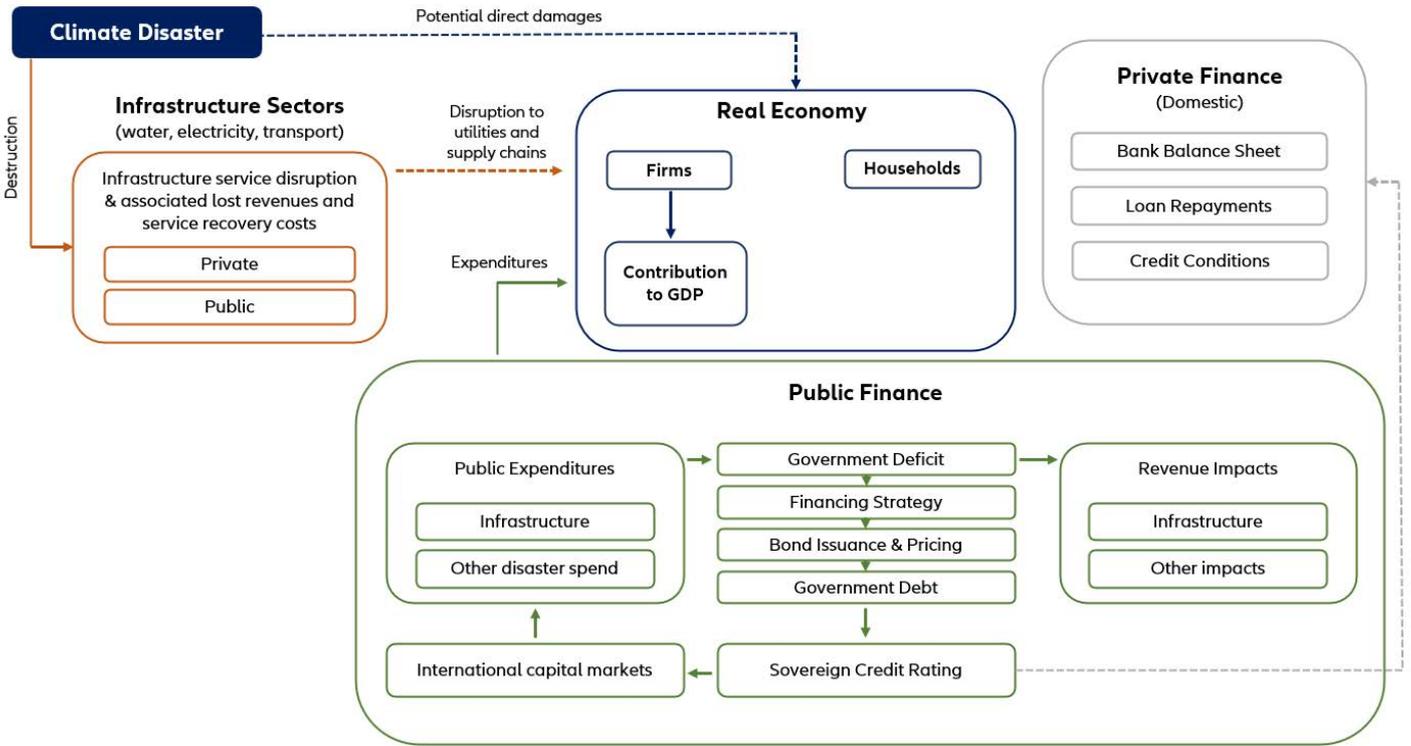


Sources: NGFS, Allianz Research

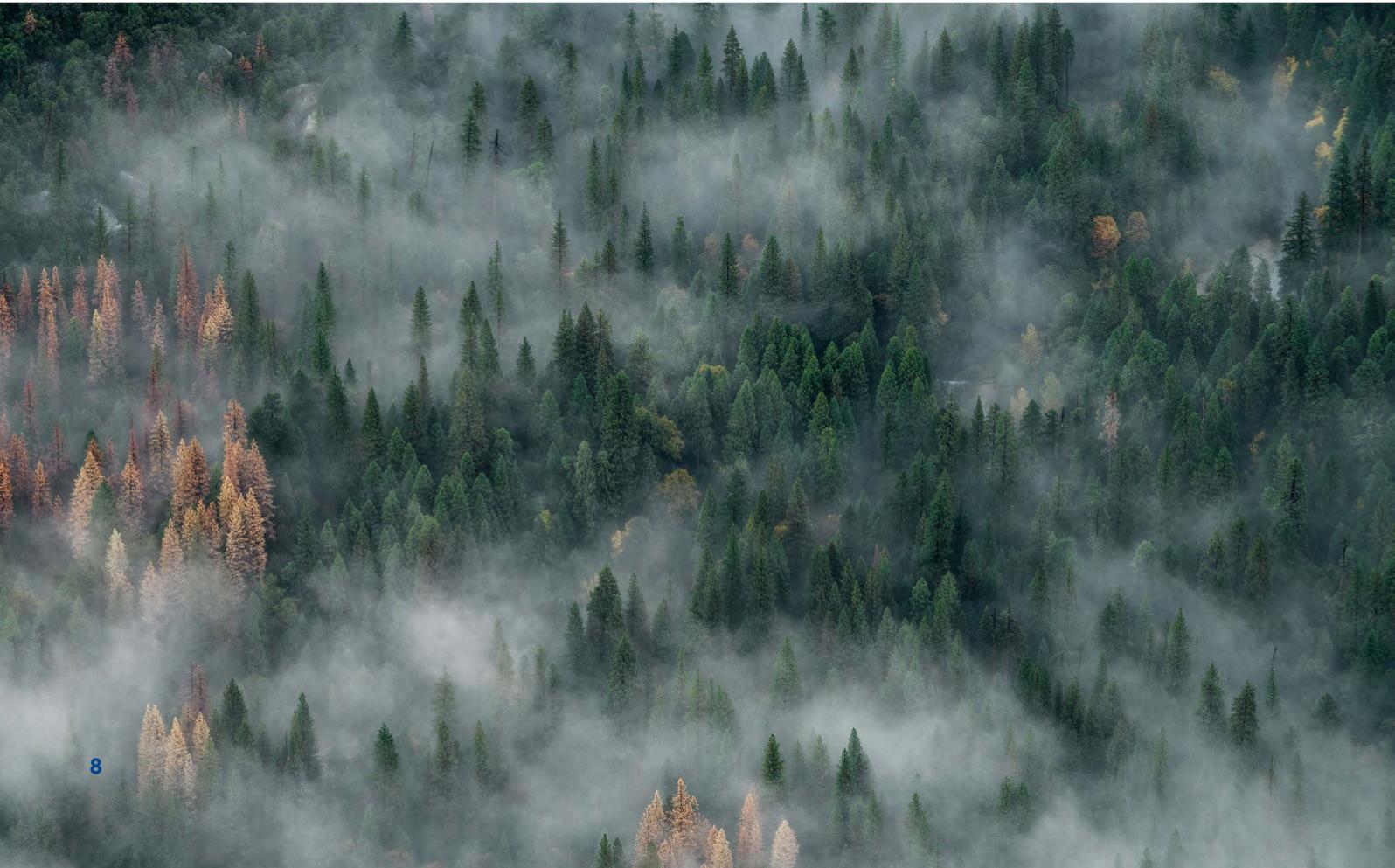
Natural disasters cause significant damage to public and private infrastructure, placing a heavy financial burden on government balance sheets as the public sector is typically responsible for covering most, if not all, of the costs of reconstruction and recovery. However, the fiscal impact extends far beyond immediate expenditures (Figure 3). The disruption of critical infrastructure, such as roads, energy grids and water systems, creates ripple effects throughout the economy, affecting businesses, households and overall productivity. Firms may experience supply-chain disruptions, lost revenues and increased operational costs, while households face income losses,

displacement and rising living expenses. These cascading effects slow economic growth, increase social welfare expenditures and reduce tax revenues, further straining public finances. In extreme cases, governments may be forced to act as the “insurer of last resort”, shouldering private sector losses when insurance markets fail to provide adequate coverage. Additionally, repeated infrastructure damage can deter investment, increase borrowing costs and weaken long-term fiscal sustainability. The widespread economic repercussions of natural disasters highlight the potentially immense cost of failing to invest in adaptation.

Figure 3: Transmission of climate shocks in the absence of adaptation



Sources: Ranger et al. (2021), Allianz Research



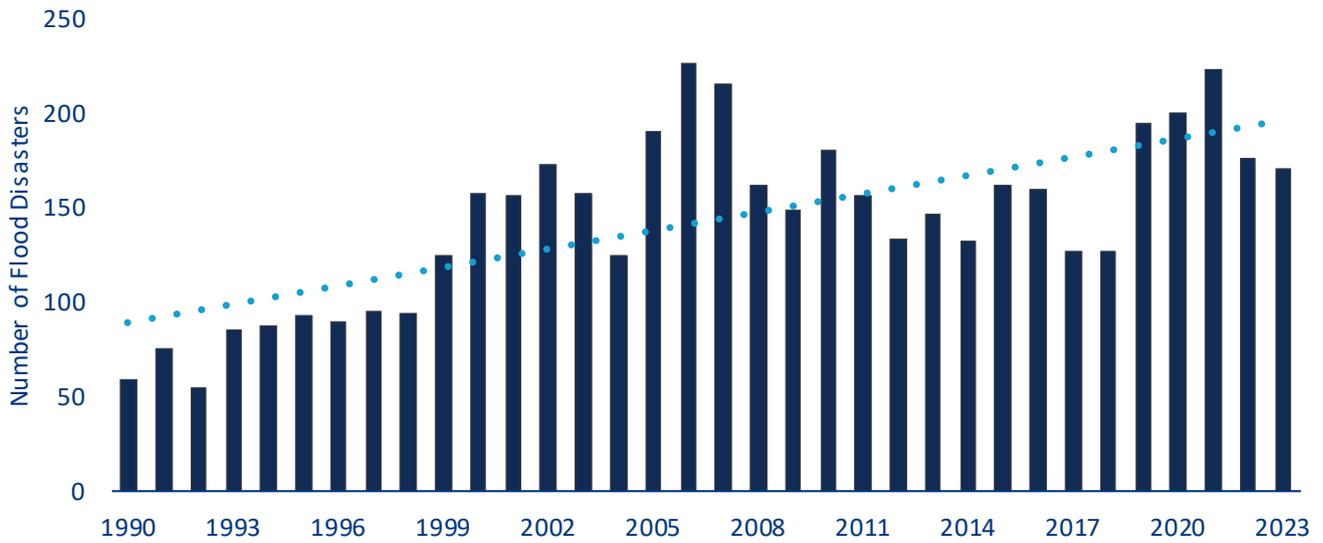


The growing financial burden of climate disasters in high-income nations

The cost of rising waters in Europe

The escalating economic damages projected under even the most ambitious climate transition pathways are no longer hypothetical; they are already manifesting in real time through increasingly severe and costly natural disasters. Urban expansion is making these impacts even worse. As cities sprawl into floodplains, coastal areas and wildfire-prone regions, more people and infrastructure are put directly in harm's way. Flooding is one of the more devastating events and its frequency has been increasing from 1990 to

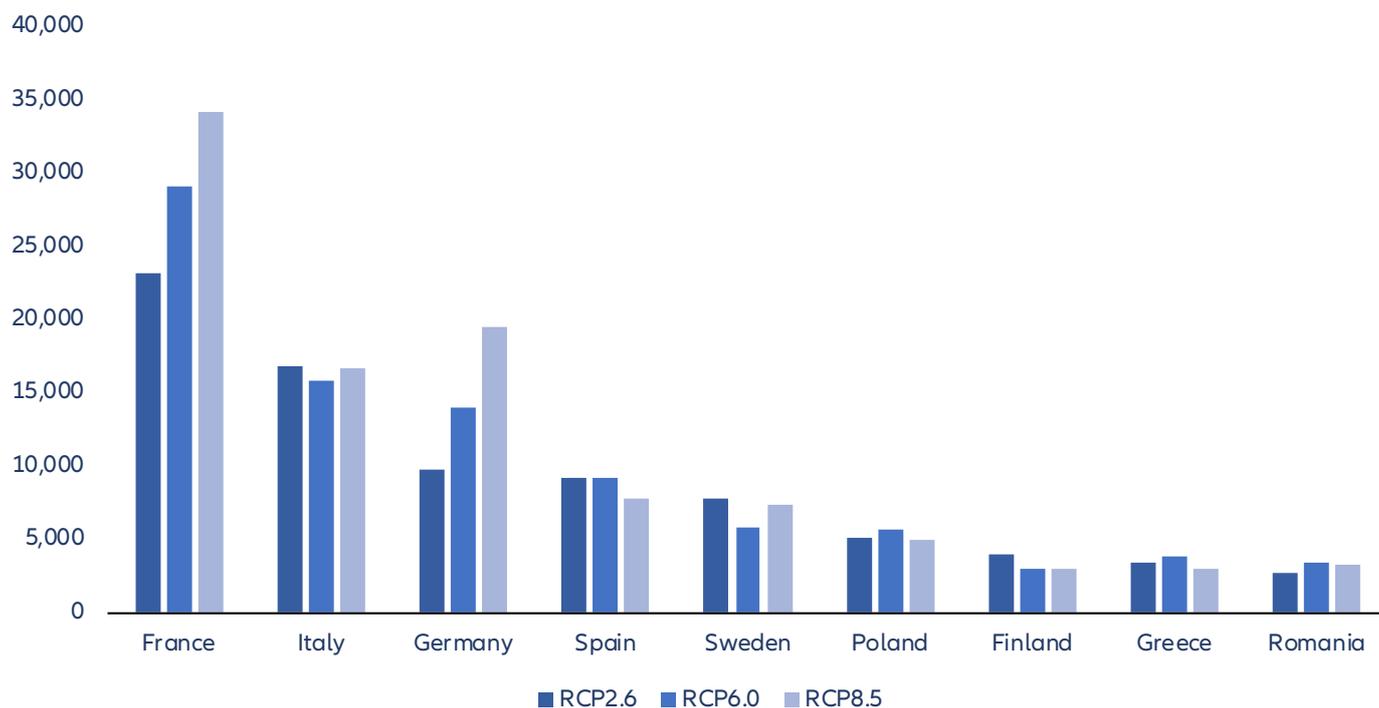
2023, with a notable upward trend over the decades (Figure 4). The number of flood events remained below 100 per year in the early 1990s but gradually increased, surpassing 150 annual events by the early 2000s. The peak years, particularly between 2003 and 2007, recorded over 200 flood disasters. Although fluctuations are present, the overall trajectory suggests a rising trend in flood occurrences, particularly in the last decade.

Figure 4: Number of flood events worldwide for the period 1990 – 2023

Sources: NOAA, Allianz Research

Without targeted adaptation measures, economic losses from river flooding are expected to escalate as both the intensity and frequency of flood events increase across all climate change scenarios. Even under a scenario with strong mitigation efforts, such as RCP2.6, which aligns with the Paris Agreement’s goal of limiting the global temperature rise to +2°C by 2050, shifting precipitation patterns will heighten flood risks. Figure 5 illustrates the projected economic impact on household income due to river flooding between 2025 and 2035. Under the RCP2.6 scenario, cumulative household disposable income losses from flood-related damages (measured in purchasing power standards, PPS) are projected to reach approximately USD107,000. National-level impacts will vary, with French households

facing cumulative losses of around USD24,000, Italian households USD17,000, and Spanish households USD9,000. In a high-emissions scenario (RCP8.5), where climate mitigation efforts are insufficient, the financial burden on households grows substantially. French and German households emerge as the most affected, with cumulative income losses significantly surpassing those under the RCP2.6 scenario. French households would experience a 47.8% increase in losses compared to RCP2.6, while German households would see their flood-related income losses double (+100.7%). These findings underscore the urgent need for proactive adaptation strategies to mitigate escalating economic risks in the face of worsening flood events.

Figure 5: Top 10 cumulative household income loss in Europe for the decade 2025 – 2035 across different emissions scenarios (EUR)

Sources: ISIMIP2b, Allianz Research

Box 1: How flooding is reshaping real estate investment risks

Real estate markets are shaped by a delicate balance of location, desirability and risk. Yet, as climate change intensifies, one risk is becoming increasingly difficult to ignore: flooding. The financial impact of floods on property values extends beyond immediate physical damage, influencing market confidence, insurance costs and long-term investment patterns.

The financial impact of flooding on real estate is deeply connected to the characteristics and distribution of the housing stock in flood-prone areas. As climate risks intensify, it is increasingly crucial to integrate flood risk considerations into urban planning, real estate valuation and policy frameworks. Several mechanisms can help mitigate financial losses, including zoning regulations that restrict construction in high-risk areas, mandatory flood insurance requirements and adjustments to property valuation models that better reflect flood exposure. A comprehensive meta-analysis by Beltrán et al. (2018), synthesizing data from 37 studies and 364 price estimates, found that homes situated within a 100-year floodplain experience an average price decline of -4.6%. This discount becomes even more severe, rising to -6.9%, immediately following a significant flood event.

Multiple factors contribute to these declines in property values. First, the physical destruction caused by flooding often leads to expensive repairs, making affected properties less desirable to buyers. Second, homes located in flood zones typically face rising insurance premiums as insurers reassess risks, increasing the cost of homeownership and further depressing demand. Third, the psychological impact of witnessing flood devastation influences market behaviour, as potential buyers become more risk-averse and reluctant to invest in flood-prone properties. Even homes that narrowly escape damage can suffer price declines due to perceived vulnerability, as demonstrated by a study by Reich et al. (2020), which examined river flooding in Zurich. This study revealed that despite mandatory insurance policies covering most flood-related damages, properties in designated flood hazard zones sold for significantly lower prices than those in safer areas. Interestingly, homes classified as low-risk appreciated in value when detailed flood risk information became publicly available, indicating that greater transparency in hazard assessments shapes market confidence and valuation.

The long-term impact of flood risk on property markets varies across regions and events. Some markets recover over time as memories of disasters fade and local flood management improves. In the US, for example, research found that the negative price effects associated with Hurricane Floyd and the 1994 Georgia floods largely disappeared within six to nine years (Bin and Landry, 2013; Atreya et al., 2013). However, in areas where climate risks are projected to worsen, flood-related price reductions may persist indefinitely.

Beyond property sales, flood risk also influences rental markets. A study by Hirsch and Hahn (2017) on the German housing market showed that homes within designated flood zones were valued at an average of EUR299 less per square meter compared to those in safer locations. Rental prices in high-risk flood zones were also 1.88% lower, even though tenants do not bear the financial responsibility for flood damage. This trend suggests that renters consider indirect risks such as uninsured household losses and the inconvenience of flood disruptions when choosing where to live. Another key finding was that proximity to rivers has a nuanced effect on real estate prices. While properties within one kilometre of a river were largely unaffected, those within 500 meters saw declines of up to -10%, reflecting heightened concerns over flood exposure.

Cities in the US are burning

The devastating wildfires that struck Los Angeles at the start of 2025 starkly illustrated the unique and alarming nature of urban firestorms, which differ significantly from traditional wildland fires. In urban settings, structures themselves act as fuel, allowing flames to rapidly consume neighborhoods as one home ignites another. In the Los Angeles area, tightly packed residences situated on steep terrain, combined with strong winds, created the perfect conditions for the fires to spread with ferocious intensity. Adding to this crisis is the phenomenon known as “hydroclimate whiplash” characterized by abrupt shifts between extreme wet and dry periods, a pattern expected to become more frequent as global temperatures rise.³ Heavy rainfall during 2023 and early 2024 had fueled abundant vegetation growth in the region, but the near-total absence of precipitation, less than one millimetre, since

July 2024 turned that green growth into a vast supply of tinder. These conditions, exacerbated by climate change, set the stage for one of the most destructive fire events in Los Angeles and U.S. history.

The economic fallout of the January 2025 wildfires underscores the scale of the disaster. Preliminary estimates⁴ indicate that property and capital losses range from USD95bn to USD164bn, with insured losses projected at USD75bn. Beyond the direct damages, the fires would significantly impact the local economy. The county’s GRP (gross regional product) is expected to contract by -0.48% in 2025, representing a loss of approximately USD4.6bn. Furthermore, the livelihoods of local businesses and workers in affected areas have been severely disrupted, with wage losses amounting to USD297mn. These figures highlight the profound economic, social and environmental consequences

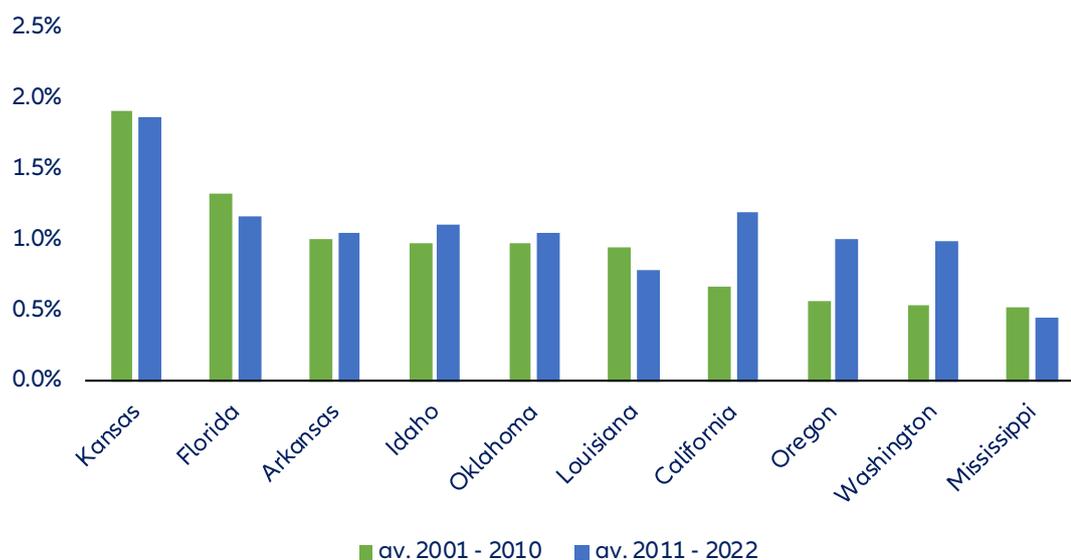
³ Hydroclimate volatility on a warming Earth | Nature Reviews Earth & Environment

⁴ Economic Impact of the Los Angeles Wildfires | UCLA Anderson School of Management

of urban firestorms in the absence of proper adaptation strategy. Wildfire activity along the US West Coast has been on the rise over the past decade, particularly in California, Oregon and Washington. Figure 6 highlights the dramatic increase in the average share of burned areas across selected US states during two periods:

2001–2010 and 2011–2022. This trend reflects the escalating intensity of climate-related factors such as prolonged droughts, heatwaves and hydroclimate whiplash, which are expected to persist and amplify the frequency and severity of wildfires in the future.

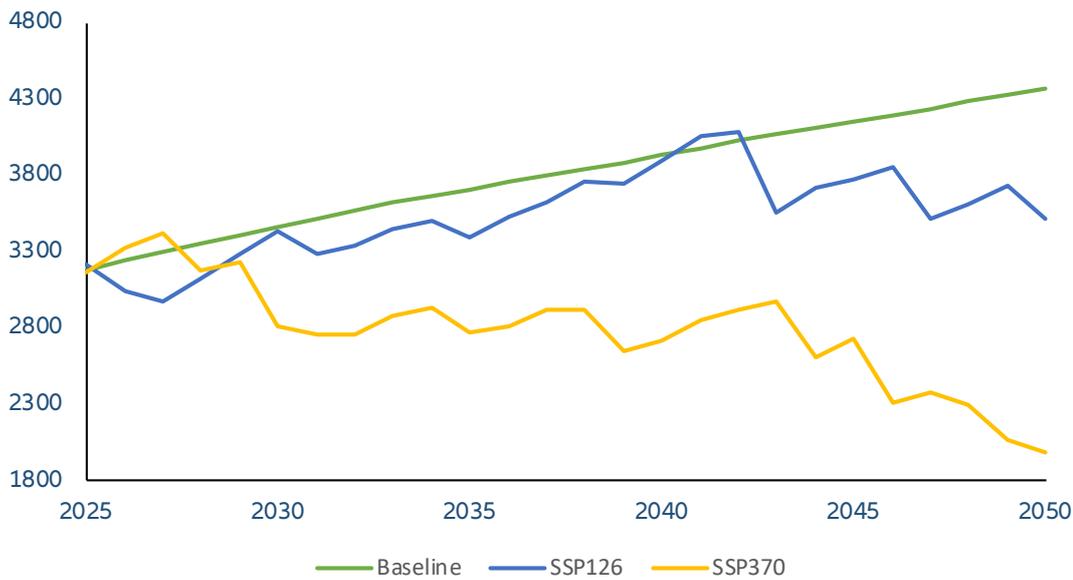
Figure 6: The average share of burned areas in the ten most affected US states: 2001–2010 vs. 2011–2022



Sources: Copernicus, Allianz Research

Under a non-adaptation assumption, future wildfire projections highlight the severe economic risks posed to California, even with ambitious climate mitigation efforts. Using the SSP126 scenario, which aligns with a +2°C warming pathway by 2050, California's Gross Regional Product (GRP) is projected to experience an average yearly decline of -0.8%. This figure reflects unavoidable economic damages even with robust mitigation. To estimate the economic cost of non-adaptation, we integrate a US wildfire damage function (Figure 7) with projections of population-weighted burned areas under two scenarios: SSP126 (+2°C) and SSP370 (+3°C). Both scenarios indicate significant economic harm, but the magnitude varies sharply. Under the SSP126 scenario, California's GRP remains relatively close to baseline levels (absence of wildfire damages) until 2040, after which losses accelerate. Between 2025 and 2050, the cumulative GRP loss is estimated to reach USD7trn. In stark contrast, the SSP370 scenario

(+3°C warming) triggers much more severe and earlier economic impacts. GRP growth would begin contracting significantly by 2030, culminating in unsustainable economic damages by 2050. The cumulative GRP loss under this high-warming scenario could total USD26trn for the same period. These findings underscore the urgent need for adaptation measures, even under the best-case SSP126 mitigation pathway. Without robust adaptation strategies, including improved land-use planning, fire-resistant infrastructure and enhanced wildfire management, California will remain highly vulnerable to escalating fire-driven economic losses. The stark divergence between the SSP126 and SSP370 scenarios illustrates the critical importance of limiting global warming to +2°C while investing heavily in local adaptation to safeguard the region's economic future.

Figure 7: California's GRP (USD bn) under three scenarios: baseline (green), SSP126 (blue) and SSP370 (yellow)

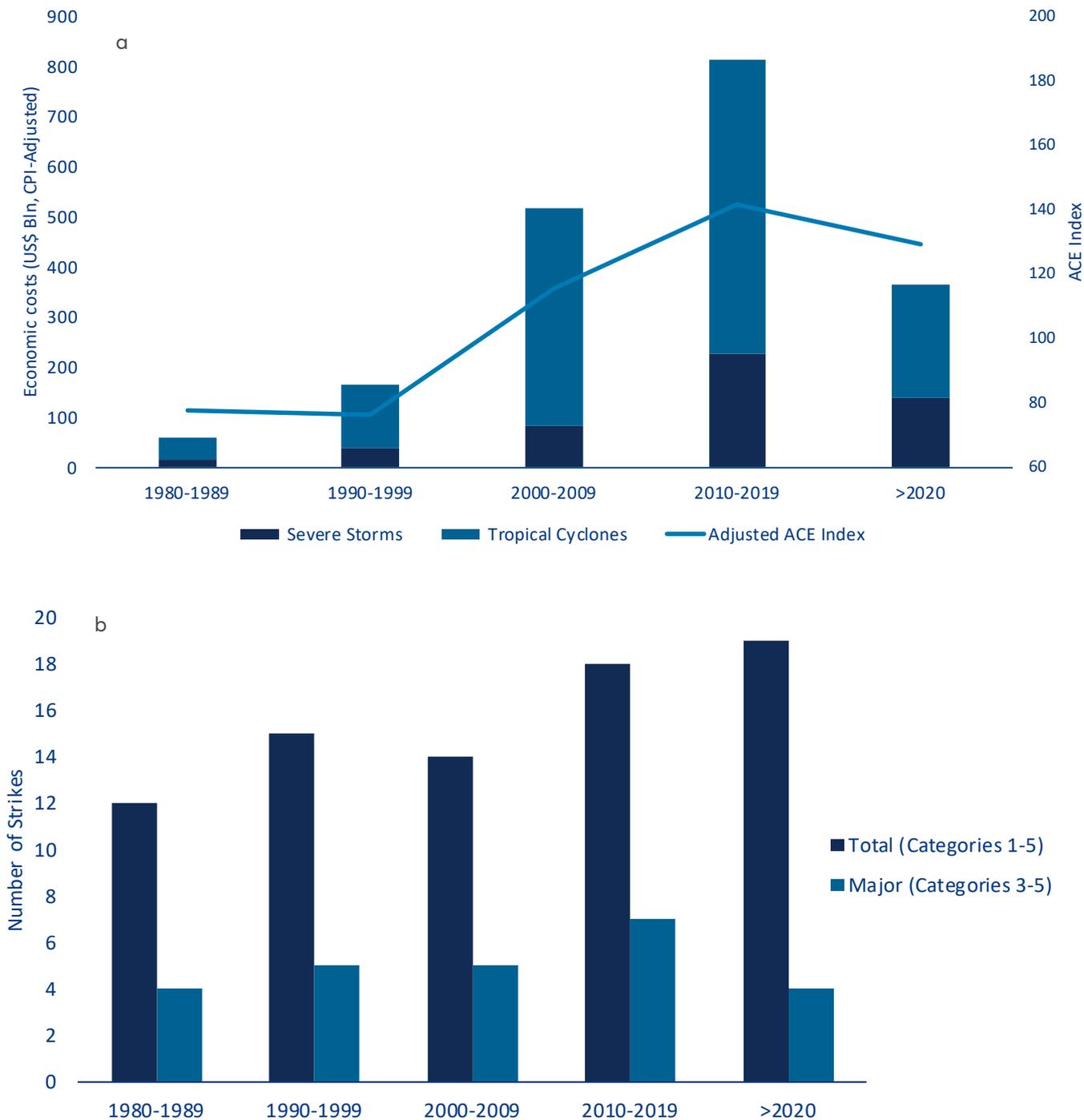
Source: Allianz Research

The looming threats of hurricanes in the US

On the top of fires, tropical cyclones have become an increasingly costly and destructive force in the US, with both economic and climatic trends pointing to a worsening crisis. A key metric in understanding cyclone behavior is the Adjusted Accumulated Cyclone Energy (ACE) Index, which measures the combined strength, duration and frequency of storms over time. As shown in Figure 8a, the ACE Index has exhibited a notable +35% increase in the 21st century, reflecting a rise in hurricane activity. However, in the most recent decade, there has been a -9% decline in the adjusted ACE Index, driven largely by a reduction in the number of major hurricanes (Categories 3–5, Figure 8b). Despite this recent decline in the most intense storms, the economic damages caused by tropical cyclones have surged dramatically. Figure 8a highlights the persistent increase in financial losses, emphasizing how rising cyclone activity and socio-economic factors have jointly amplified disaster costs. The 2010 – 2019 period recorded the highest economic

losses, reaching approximately USD731bn, largely due to the devastating impacts of Hurricanes Harvey, Irma and Maria. Even more concerning, the current decade, despite being only a few years in, has already incurred USD460bn in damages, an amount that doubles the total losses recorded between 1980 and 1999, which amounted to USD225bn. This disparity between a declining ACE Index in the most recent decade and escalating economic damages highlights an important shift: even when major hurricanes become slightly less frequent, rising exposure and vulnerability in coastal regions significantly amplify financial losses. More people and critical infrastructure are now concentrated in high-risk areas, making even lower-category hurricanes capable of inflicting severe economic consequences. This underscores the growing importance of adaptation and resilience-building measures to minimize financial losses, regardless of fluctuations in cyclone intensity.

Figure 8: Historical trends in hurricane-related damages in the US since 1980: a) illustrates the trajectory of economic losses alongside the Adjusted Accumulated Cyclone Energy (ACE) Index; b) presents the evolution of hurricane occurrences by category

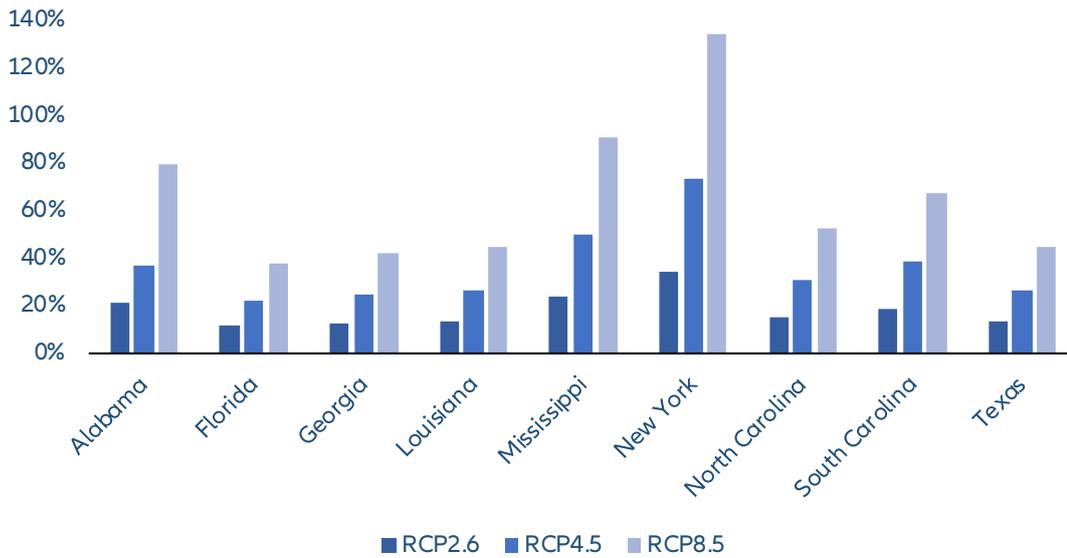


Sources: NOAA, NHC, EPA, Allianz Research

The cost of inaction on hurricane adaptation in the US is projected to be severe, with economic damages expected to rise significantly under all climate scenarios. As shown in Figure 9, the extent of financial losses varies across states but remains consistently high, especially under high-emission scenarios. In Florida, for example, economic damages are projected to rise by +12% even under the most ambitious mitigation pathway (RCP2.6), but under RCP8.5, where emissions remain unchecked, the increase could reach +38%. Similarly, in Louisiana and Mississippi, the projected damages escalate sharply under less restrictive climate policies, indicating that vulnerable coastal areas will face mounting financial risks. New York stands out as one of the most critically affected states, where economic losses are expected to become unsustainable. Even under RCP2.6, damages are projected to rise by +35%,

posing significant challenges to urban resilience. Under RCP8.5, the financial toll could become catastrophic, with damages surging by +134%. Such an increase in losses could make certain assets effectively uninsurable, leading to a collapse in real estate values and a sharp rise in insurance premiums. Other states, such as North Carolina and South Carolina, also face stark increases in damages, underscoring the urgent need for adaptation measures, regardless of the emissions scenario. The findings suggest that without significant investments in adaptation strategies, the financial burden of hurricanes will continue to grow, placing immense strain on state and federal budgets, insurance markets and local economies.

Figure 9: Projected increase in hurricane-related economic damages across the most affected US states by 2050 under different climate scenarios



Sources: CLIMADA, Allianz Research



The disproportionate burden of climate disasters on developing economies

Climate disasters have vastly different consequences for developed and developing economies, largely due to disparities in economic resilience, infrastructure and institutional capacity. In wealthier nations, advanced early-warning systems, stronger infrastructure and well-funded disaster-response mechanisms help minimize damage and accelerate recovery. In contrast, developing countries face weaker safety nets, limited financial resources and fragile infrastructure, making them far more vulnerable. The economic burden of disasters is also disproportionately higher in low-income nations, where people often depend on climate-sensitive livelihoods like farming.

Climate-related disruptions to infrastructure impose an economic burden of at least USD390bn annually on emerging and developing economies⁵. Research from the World Bank and the University of Oxford⁶ highlights that over 200,000 kilometers of roads worldwide are currently at risk from climate-related hazards. The most severe consequences of infrastructure failures fall on the poorest communities, exacerbating income losses and restricting access to essential services, ultimately slowing progress on poverty reduction. Moreover, the economic strain from infrastructure failures can destabilize public finances, lower productivity and hinder growth, investment and poverty-alleviation efforts.

⁵ World Bank Document

⁶ Open Knowledge Repository

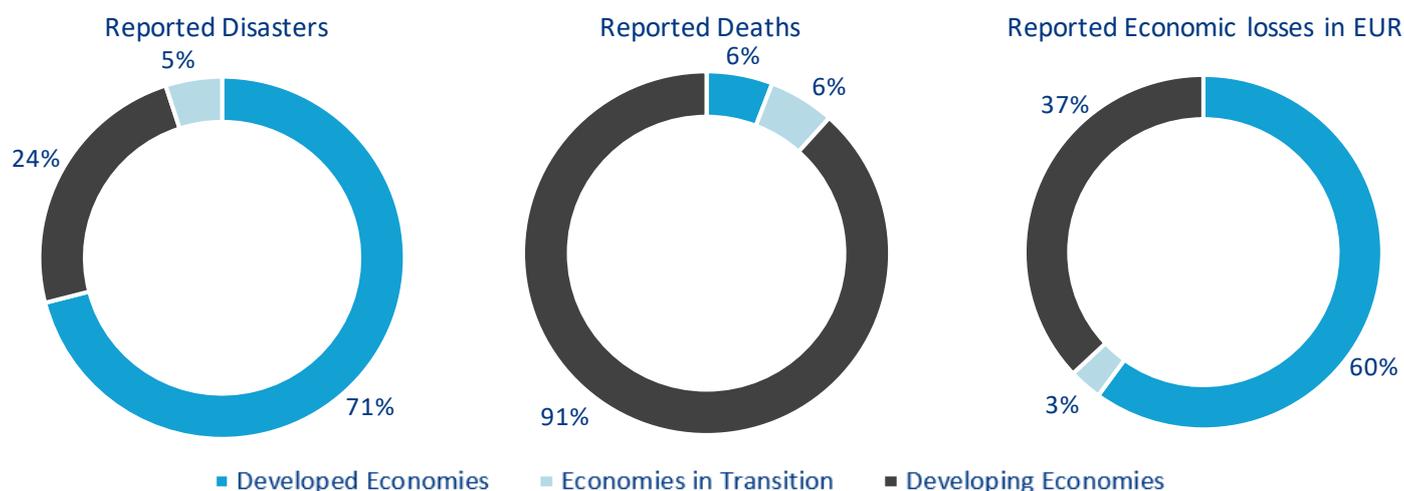
Climate-related disasters are keeping households in developing economies trapped in poverty⁷. A study tracking families in Mozambique over time found that most rural households remain at a similar economic level, just above the poverty line, highlighting persistent underdevelopment. A key driver of this cycle is extreme weather events like droughts. When droughts strike, families must find ways to cope. Those with access to additional income sources or assets they can sell are often able to safeguard their most critical resources, such as farmland or livestock. However, families without these options are forced to deplete the very assets they rely on for their livelihoods, making recovery even more difficult. This cycle – losing essential resources, struggling to rebuild and remaining vulnerable to the next disaster – creates a poverty trap, where each climate shock deepens economic hardship and limits opportunities for long-term progress.

Developing economies bear a significantly higher toll from extreme weather events, both in terms of human and economic consequences, compared to wealthier nations. Figure 10 highlights the stark contrast in the impact of floods, revealing that while 71% of reported disasters occurred in developed countries, an overwhelming 91% of recorded fatalities were in developing nations. This highlights the heightened vulnerability of lower-income regions, where a significant insurance gap, reflected in limited infrastructure, weaker early warning systems and constrained emergency response capabilities, contributes to higher mortality rates. Although 60% of reported economic losses from disasters between 1990 and 2023 were recorded in developed economies, the financial burden relative to GDP is disproportionately greater for developing nations. In high-income countries, over 80% of natural disasters resulted in losses of less than 0.1% of GDP, with no single event exceeding 3.5%. This indicates that while wealthier nations may experience large absolute

financial damages, their economic resilience allows them to recover more effectively, unlike vulnerable economies where disaster-related losses can derail growth and development for years. In contrast, the financial devastation caused by climate-related disasters in Least Developed Countries (LDCs) and Small Island Developing States (SIDS) is significantly more severe. In LDCs, approximately 7% of recorded disasters resulted in economic losses exceeding 5% of GDP, with some cases approaching 30%, severely hindering economic growth and development for decades. The situation is even more alarming in SIDS, where one in five disasters led to damages surpassing 5% of GDP, and in extreme cases, entire economies were effectively wiped out with damages exceeding 100% of annual economic output. Events such as Cyclone Idai in 2019, which caused USD3.3bn in damages across Mozambique, Zimbabwe and Malawi, and the catastrophic 2022 floods in Pakistan, which resulted in USD15.2bn in economic losses, equivalent to 4% of GDP, highlight the disproportionate financial burden faced by developing nations. A key driver of this disparity is the lack of accessible and affordable climate risk insurance in vulnerable regions. Unlike developed nations, where comprehensive insurance coverage helps mitigate financial losses, many low-income countries struggle with high insurance costs and limited – or *the absence of* – market availability. Without financial protection, governments, businesses and individuals in developing economies are often forced to bear the full cost of disaster recovery, straining public resources and increasing dependence on international aid. This structural financial vulnerability reinforces long-term economic instability, limiting resilience to future climate shocks.

⁷ [Assets, Shocks, and Poverty Traps in Rural Mozambique - ScienceDirect](#)

Figure 10: Global distribution of weather-related disaster impacts by economic group



Sources: WMO, Allianz Research

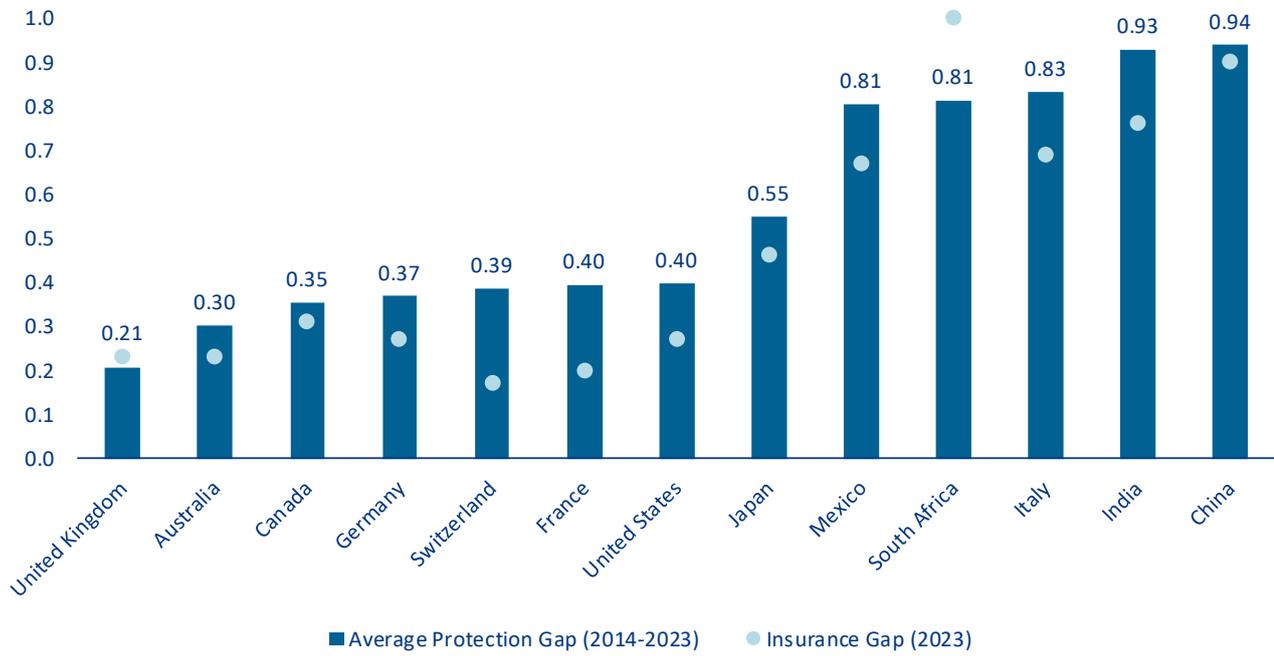
The insurance gap, or the difference between economic losses from disasters and the portion covered by insurance, remains a critical issue in climate risk management, particularly in high-risk developing regions where insurance remains unaffordable or unavailable. As extreme weather events intensify due to climate change, the disparity in insurance coverage across countries has become increasingly apparent, leaving some nations far more exposed to financial losses than others. Figure 11 highlights stark differences in the insurance gap across various countries, with developing economies such as China, India and South Africa showing alarmingly high levels of underinsurance. China and India, for instance, exhibit insurance gaps of 94% and 93%, respectively, meaning that nearly all economic damages from disasters remain uninsured. Similarly, South Africa faces an 83% gap, reflecting a significant lack of financial protection against climate risks. These figures underscore the structural challenges faced by emerging economies, where limited access to affordable insurance leaves governments, businesses and individuals vulnerable to catastrophic financial losses. In contrast, developed economies show much lower insurance gaps, yet disparities remain evident. Countries such as

the UK (21%), Australia (30%) and Canada (35%) have relatively low insurance gaps over the period 2014-2023, reflecting well-established insurance markets and strong financial mechanisms to absorb disaster-related losses. However, other advanced economies, including the US (40%) and Japan (55%), still face significant gaps, suggesting that even high-income nations struggle with full insurance coverage, particularly in regions prone to frequent and severe natural disasters. Within Europe, notable differences can be observed among Italy, Germany and Switzerland. While Italy has a strikingly high insurance gap of 83%, Germany and Switzerland fare much better, with gaps of 37% and 39%, respectively. Italy's high insurance gap leaves the country vulnerable to escalating natural catastrophe risks, with 75% of privately owned houses exposed yet minimal insurance coverage. The lack of a structured public-private insurance framework has resulted in 98% of earthquake-related economic losses between 1980⁸ and 2021 remaining uninsured, despite limited tax incentives introduced in 2018. Rising climate-related disasters are expected to shrink Italy's GDP by -3.7% by 2050 and up to -8.5% by 2100, further amplifying economic instability⁹.

⁸ Protecting properties in Italy against earthquakes | Lockton

⁹ Italy - G20 Climate Risk Atlas

Figure 11: Insurance gap across countries (average 2014-2023)



Sources: Swiss Re, Allianz Research



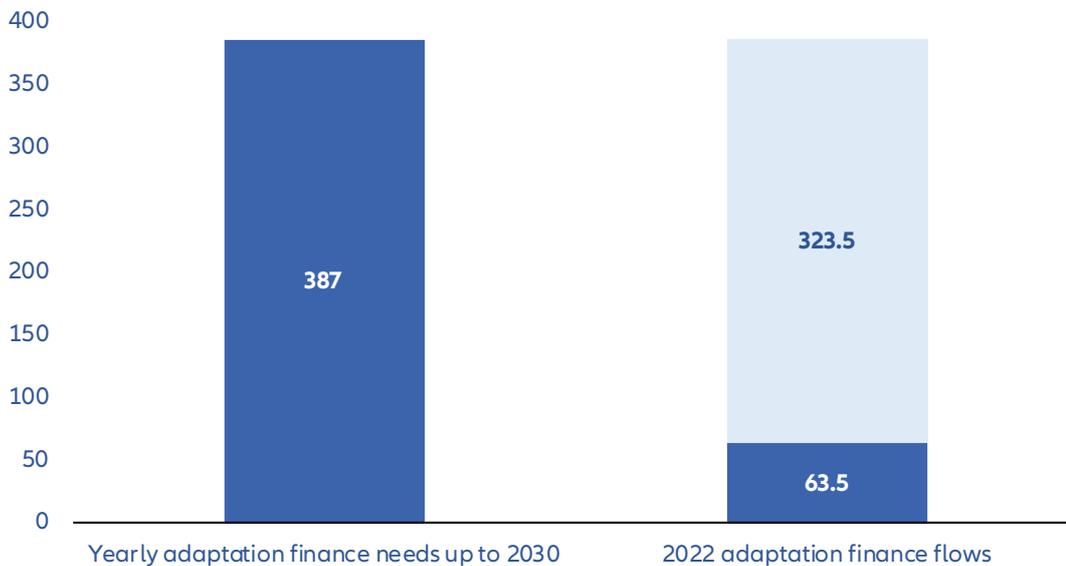


Adaptation finance is lagging behind mitigation finance

Despite escalating climate impacts, global investments in adaptation remain woefully inadequate (Figure 12).

The world's most affected 55 countries lost a staggering 20% of their GDP to climate change between 2000 and 2019, yet the financial response has not matched the scale of the crisis. Adaptation finance, which funds efforts to strengthen resilience and reduce vulnerability, is falling dramatically short. By 2030, the annual need for adaptation funding will soar to USD387bn. Yet, in 2022, global adaptation finance flows reached only USD63.5bn. This leaves a massive USD323.5bn gap, exposing millions to escalating risks. Effective adaptation demands a three-pronged approach: faster development, more resilient infrastructure and targeted adaptation measures. However, current finance mechanisms overwhelmingly focus on the last one, neglecting the foundational elements essential for long-term climate resilience, especially in the world's poorest nations. Even with ambitious emissions

reductions, the reality is clear: climate impacts are here to stay. Adaptation is no longer an option; it is a survival imperative and a prerequisite for sustaining long-term investments in mitigation. Nowhere is the funding shortfall more alarming than in developing countries, which bear the brunt of climate extremes. Despite receiving USD50bn in adaptation finance in 2022, this remains far from sufficient, particularly when their adaptation needs are projected to reach USD300bn per year by 2030, according to the UNEP estimates. Without urgent financial commitments, climate vulnerability will deepen, economic losses will escalate and progress on the sustainable development goals (SDGs) will be reversed.

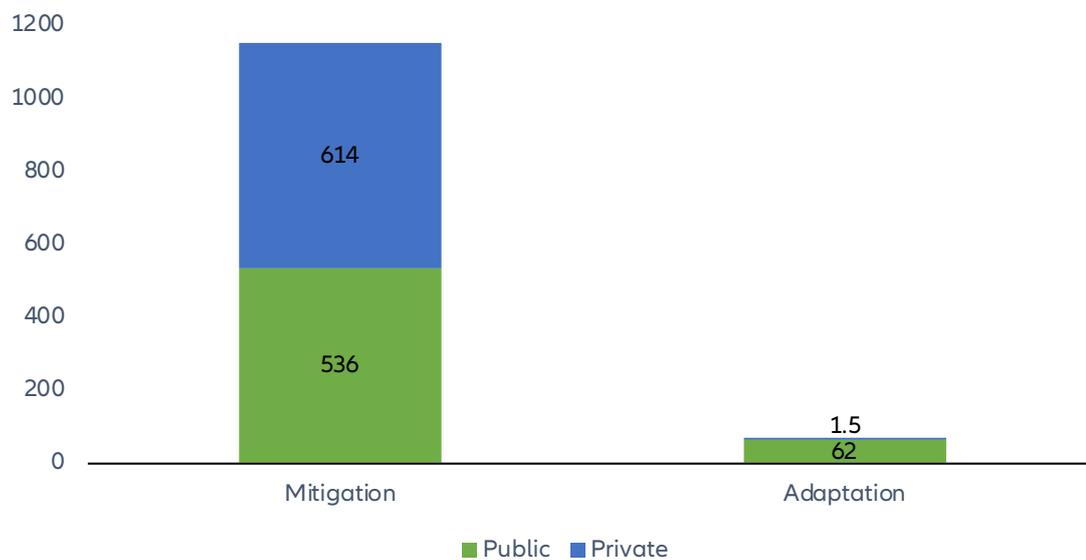
Figure 12: Adaptation finance gap in 2022 (USD, bn)

Sources: UNEP, Climate Policy Initiative, Allianz Research

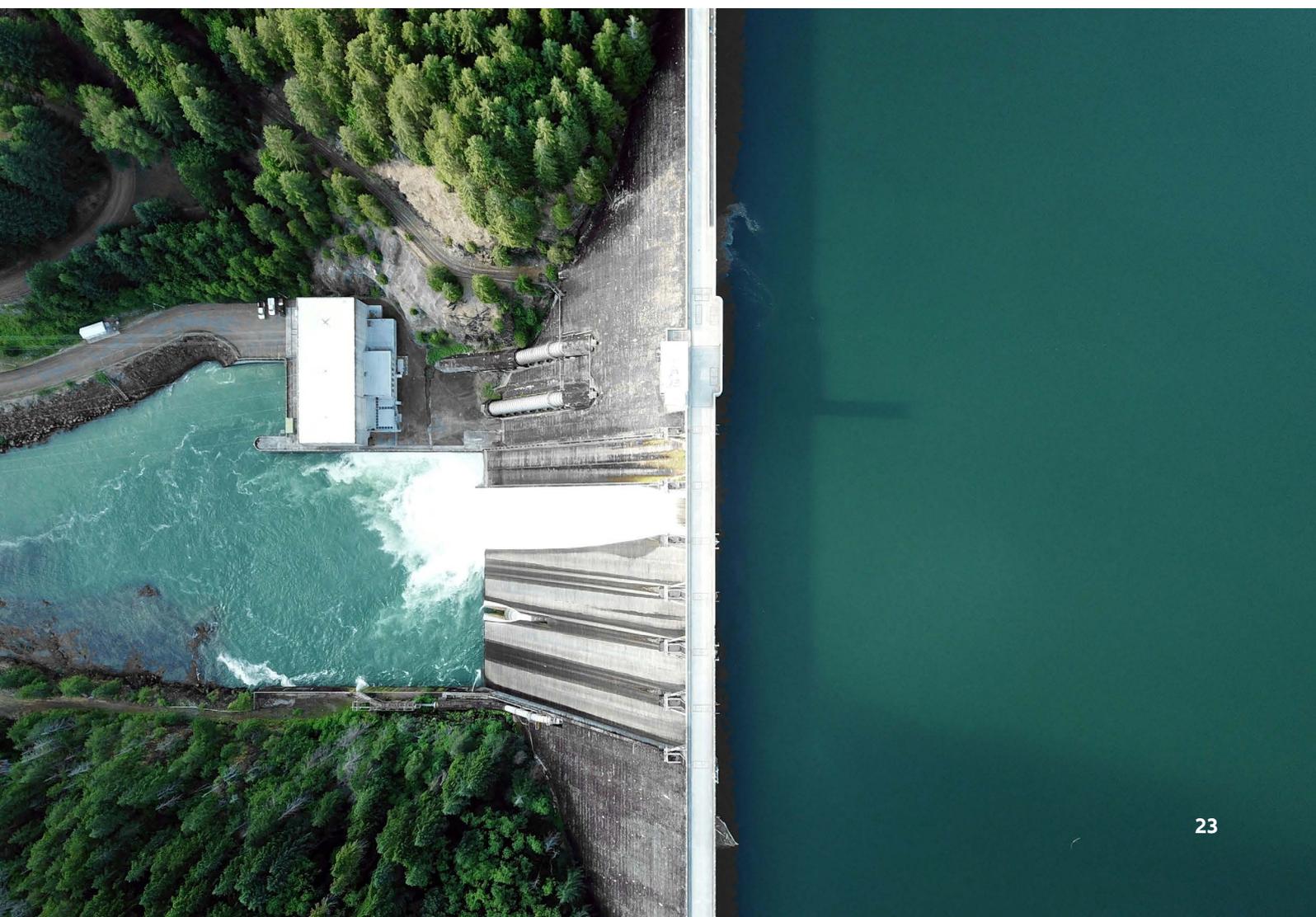
The lack of private sector engagement in adaptation finance remains a significant barrier to strengthening global climate resilience. As shown in Figure 13, private finance is overwhelmingly directed toward mitigation, contributing USD614bn in 2022, while its involvement in adaptation was just USD1.5bn. In contrast, adaptation finance remains heavily dependent on public funding, which accounted for 98% of total adaptation investment. This stark imbalance highlights the systemic challenges that discourage private investors from supporting adaptation efforts. Unlike mitigation investments such as renewable energy, which offer well-established revenue streams and predictable financial returns, adaptation projects typically provide broad societal benefits rather than direct profits. Investments in flood defense, resilient infrastructure and ecosystem protection, for example, help communities withstand climate shocks but do not generate immediate financial gains. This perception of low or uncertain returns makes adaptation a less attractive option for investors focused on maximizing profits. Furthermore, adaptation projects often require long implementation periods of 10 to 20 years, making them less appealing to private investors

seeking faster payback and higher liquidity. Another key barrier is the lack of standardized data and financial models for adaptation investments. Investors rely on risk assessments and financial forecasts to determine potential returns, but the benefits of adaptation, such as reducing climate-related losses, are difficult to quantify. The absence of clear benchmarks and performance indicators increases uncertainty, making adaptation finance appear riskier. Additionally, adaptation projects tend to be smaller in scale, requiring fragmented investments across multiple sectors and regions. This differs from mitigation finance, where large-scale renewable energy projects offer clear economies of scale and stronger financial incentives. Despite these challenges, opportunities exist for greater private sector participation in adaptation finance. To scale up private sector involvement in adaptation finance, a fundamental shift in perception is needed, alongside stronger policy incentives and clearer financial valuation of adaptation benefits. Without these changes, adaptation will continue to rely almost entirely on public funds, limiting the ability of communities and economies to build climate resilience at the scale required.

Figure 13: Public-private structure of mitigation and adaptation finance in 2022 (USD, bn)



Sources: Climate Policy Initiative, Allianz Research





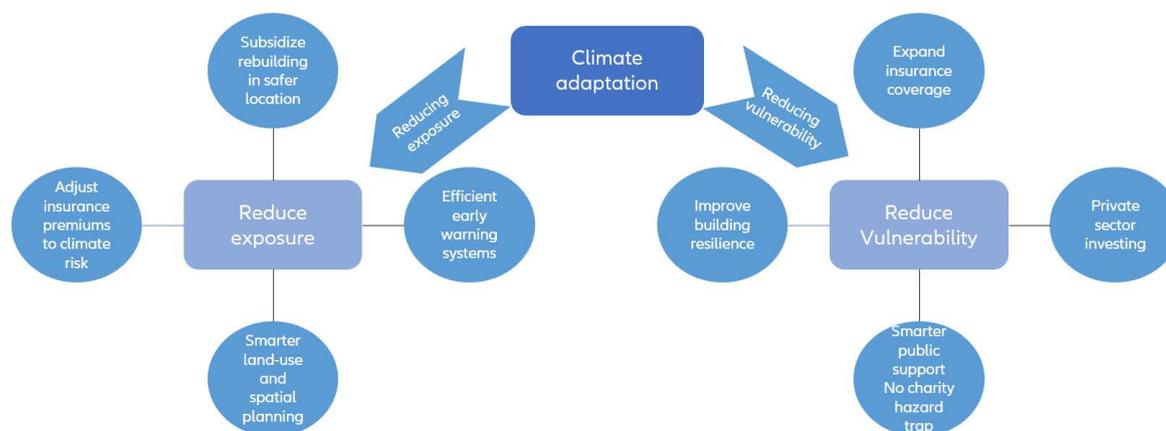
Strengthening climate adaptation for a resilient future

Investing in climate adaptation through resilient infrastructure and sustainable finance is a powerful driver of inclusive development, supporting over 92% of the Sustainable Development Goals (SDGs). Such investments not only strengthen economies but also create new jobs, expand trade and enhance access to essential services like water, energy, education and healthcare. To meet the SDGs, additional global infrastructure investment must exceed USD1trn annually until 2040, with over 70% of this funding needed in emerging and developing economies (EMDEs). Notably, the additional cost of integrating climate resilience accounts for just 3% of total investment needs, yet it delivers a net economic benefit of USD4.2trn (UNEP, 2025).

At its core, climate adaptation is about enhancing resilience to withstand the increasing impacts of climate change. Climate-related damages stem from three main factors: the frequency and intensity of climate hazards, the level of exposure (people, assets and infrastructure at risk) and the vulnerability of those exposed, whether financial or physical. While reducing (or limiting) the frequency and severity of climate hazards falls under the domain of climate mitigation, through greenhouse-gas reduction efforts,

adaptation focuses on addressing exposure and vulnerability to limit the overall damage (Figure 14). Reducing exposure requires smarter land-use planning and stricter regulations to prevent development in high-risk areas. For instance, limiting construction in coastal zones prone to hurricanes or floodplains can significantly reduce future disaster losses. At the same time, reducing vulnerability demands both physical and financial resilience. Investing in climate-resilient infrastructure, such as elevated buildings in flood-prone areas or heat-resistant urban design, can help mitigate physical risks. On the financial side, improving access to insurance and strengthening government support mechanisms are critical. However, overreliance on public assistance can create the risk of a “charity hazard” (see discussion above), where individuals and businesses reduce their own risk-management efforts in anticipation of government bailouts. To close the gap in adaptation finance, strong public policy is essential in three key areas: regulating urban development to reduce climate exposure, investing in resilience to minimize vulnerability and de-risking adaptation finance to attract private capital and strengthen insurance mechanisms, ultimately narrowing the adaptation financing gap.

Figure 14: Leveraging adaptation finance to reduce exposure and vulnerability



Source: Allianz Research

The critical role of public policy

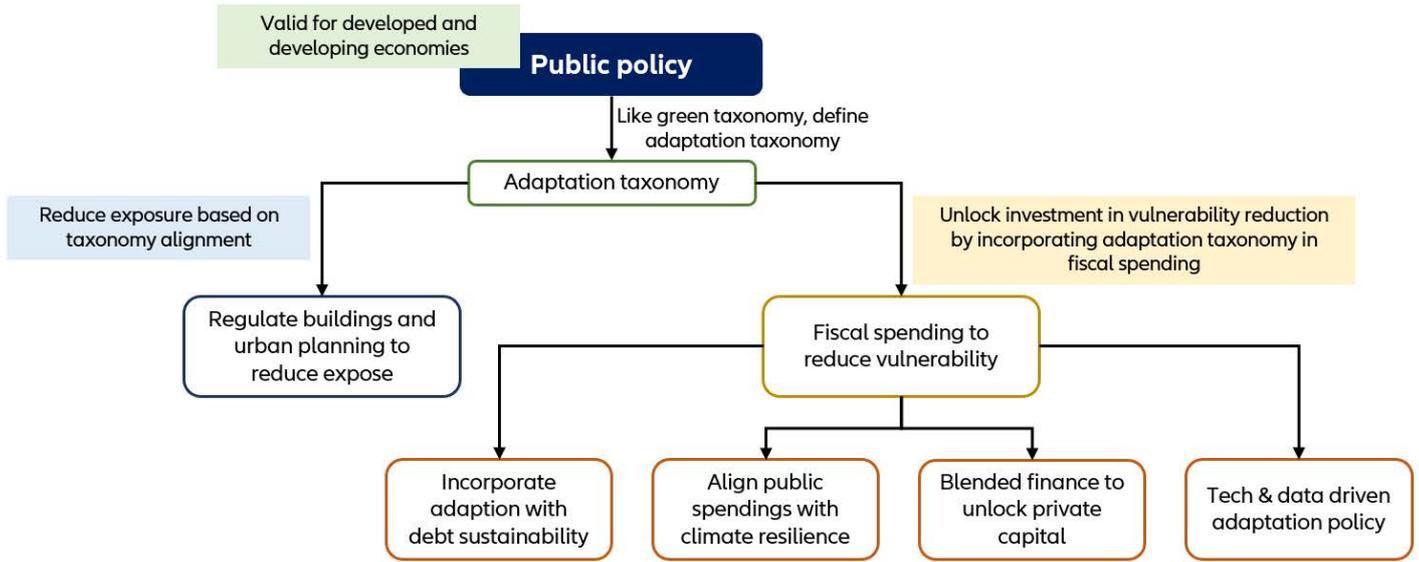
The foundation of an effective public policy for climate adaptation, in both developed and developing economies, is the establishment of a clear adaptation taxonomy, similar to the EU Green Taxonomy¹⁰.

Such a framework is essential for tracking regulatory requirements, public expenditures and financial flows directed toward adaptation efforts. By providing a structured approach, an adaptation taxonomy ensures that resources are strategically allocated to align with the two main goals of climate adaptation, which consist of reducing exposure and vulnerability (Figure 15). Increasing investment in resilient – through inclusive and sustainable infrastructure – is essential to reducing long-term vulnerability to climate change while fostering development and poverty alleviation. The public sector plays a central role in this effort. Strategic fiscal spending can unlock adaptation investment in multiple ways (Figure 15). First, rethinking debt sustainability to incorporate adaptation benefits can create fiscal space for resilience investments. Second, aligning public expenditures with climate resilience goals

ensures that spending actively contributes to long-term adaptation. Third, blended finance mechanisms can help mobilize private capital by de-risking investments in adaptation projects. Additionally, coordinating fiscal and broader public policies can attract investment in ways that support both adaptation and nature-based solutions. Crucially, closing both the investment and resilience gaps requires a well-aligned and effective fiscal policy. Numerous studies highlight the significant fiscal advantages of adaptation investments, not only by reducing the costs of reconstruction and recovery after climate disasters but also by minimizing disruptions to essential services, stabilizing tax revenues and fostering long-term economic growth, employment and development. Finally, investing in data as a public good is critical for informing resilient investment decisions, improving risk assessments and enabling evidence-based policymaking.

¹⁰ [Tracking and Mobilizing Private Sector Climate Adaptation Finance - CPI](#)

Figure 15: How can public policy reduce exposure and vulnerability to climate hazards

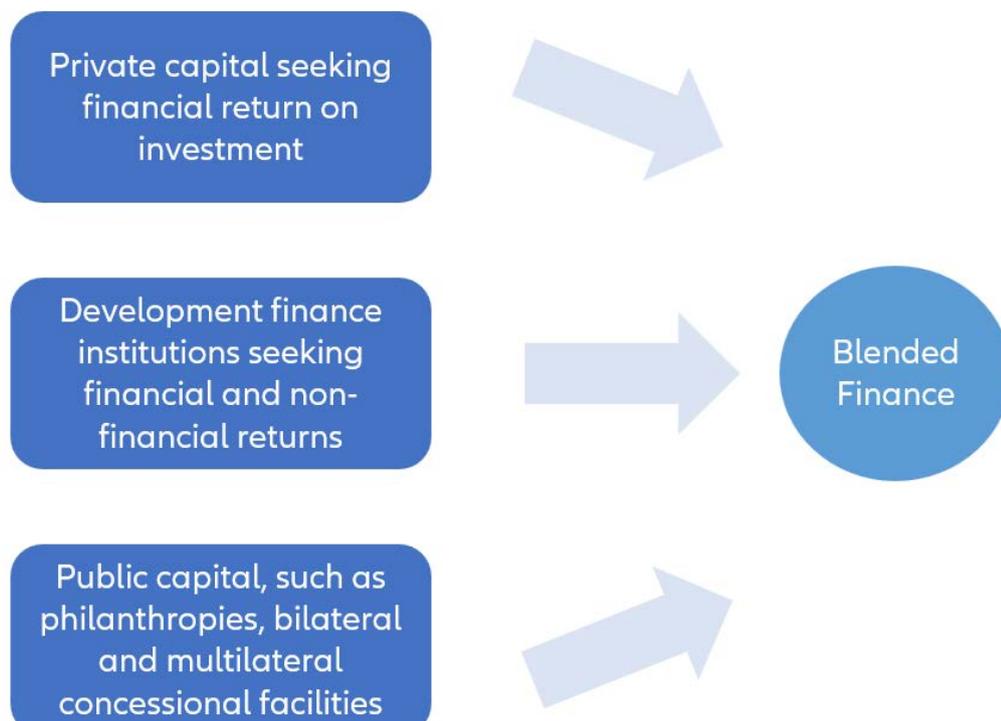


Source: Allianz Research

Blended finance offers a critical mechanism for aligning public and private sector priorities in climate adaptation funding. It involves leveraging concessional public funds to attract private capital, ensuring that investment flows into projects that might otherwise be deemed too risky or unprofitable. This approach requires collaboration among a wide range of stakeholders, including governments, philanthropic organizations, development banks, institutional investors and private financial institutions (Figure 16). The concept of blended finance was formally recognized by the United Nations in 2015 as part of the Addis Ababa Action Agenda on Financing for Development, where it was defined as a method of combining public concessional financing with private capital and expertise to drive sustainable investment. By strategically deploying limited public resources, blended finance can help

lower investment risks, making climate adaptation projects more appealing to institutional investors and unlocking capital that might not otherwise be available for resilience-building initiatives. For blended finance to be truly effective, the right policy and regulatory frameworks must be in place, particularly in emerging and developing economies where investment risks can be higher and adaptation gap remains critical to close. Creating an enabling environment requires structured financial mechanisms that ensure concessional funds are used to incentivize private sector participation while maintaining long-term financial viability.

Figure 16: Leveraging adaptation finance to reduce exposure and vulnerability



Source: Allianz Research

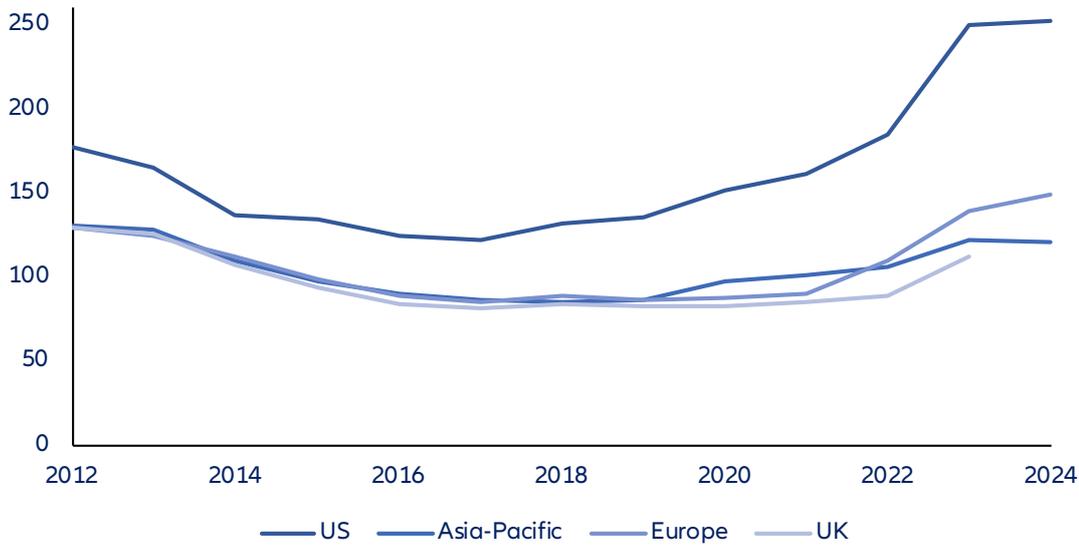
Expanding insurance for a climate-ready world

Expanding insurance coverage is a key strategy for reducing vulnerability to climate-related hazards.

However, the cost of property insurance has been rising sharply, particularly in high-risk areas. In the US, premiums for properties exposed to hurricanes and wildfires have surged by over +30% since 2020, making coverage increasingly unaffordable for many homeowners. A primary driver of these rising costs is the escalation in reinsurance rates as insurers face growing financial risks due to more frequent and severe climate disasters¹¹. Over the past decade, catastrophe-related property reinsurance costs have surged across all major markets (Figure 17). Since 2017, property catastrophe reinsurance rates have surged by roughly +75% in the EU, +38% in the Asia-Pacific region and +37% in the UK. In the US, however, the trend has been even more pronounced,

with the rate-on-line (RoL) more than doubling over the same period, rising by approximately +107%. While multiple factors influence reinsurance pricing, the escalating frequency and intensity of extreme weather events are likely to lead to further contract repricing. This, in turn, can push primary insurers to adjust their own pricing models, ultimately raising costs for policyholders. As risks grow, insurers may also scale back coverage or withdraw entirely from high-risk areas. Given that most insurance policies are renewed annually, such changes can occur suddenly, leaving businesses and homeowners with limited options. In some cases, insurers may justifiably reduce their offerings where risks become too volatile or unpredictable.

¹¹ Property Insurance and Disaster Risk: New Evidence from Mortgage Escrow Data | NBER

Figure 17: Evolution of reinsurance premiums (rate-on-line index, RoL)

Sources: Guy Carpenter Regional Property Catastrophe Rate-on-Line Index, Allianz Research

Beyond affordability concerns, the insurance gap is shaped by a complex interplay of supply and demand factors, with stark differences between developed and developing economies. On the demand side, participation in natural catastrophe insurance remains low due to several barriers. In wealthier nations, individuals and businesses often rely on government relief programs after disasters, reducing the incentive to purchase coverage, an effect known as charity hazard. Additionally, many policyholders face uncertainty about policy exclusions, complex claims processes and past negative experiences, discouraging uptake. In developing economies, the challenge is even greater, as low financial literacy, lack of trust in insurers, and limited disposable income further suppress demand. On the supply side, climate change is making risk assessment and pricing more complex as disasters become more frequent and severe. Insurers in developed economies struggle with geographic risk concentration, where entire regions and industries are exposed to the same hazards, increasing the likelihood of simultaneous

large-scale claims. Moreover, catastrophe risks follow a fat-tailed distribution, meaning extreme losses are not just possible but increasingly likely, requiring insurers to hold substantial financial reserves. In developing economies, however, the primary issue is the absence of well-developed insurance markets. Weak regulatory frameworks, lack of actuarial data and limited financial capacity prevent the emergence of affordable and efficient insurance solutions, leaving millions vulnerable to climate hazards with no financial safety net. Closing this gap requires tailored solutions, from regulatory reforms and innovative risk-sharing mechanisms in developing countries to improved risk modeling and public-private partnerships in developed ones (Figure 18).

Figure 18: Expanding insurance to reduce climate hazards vulnerability

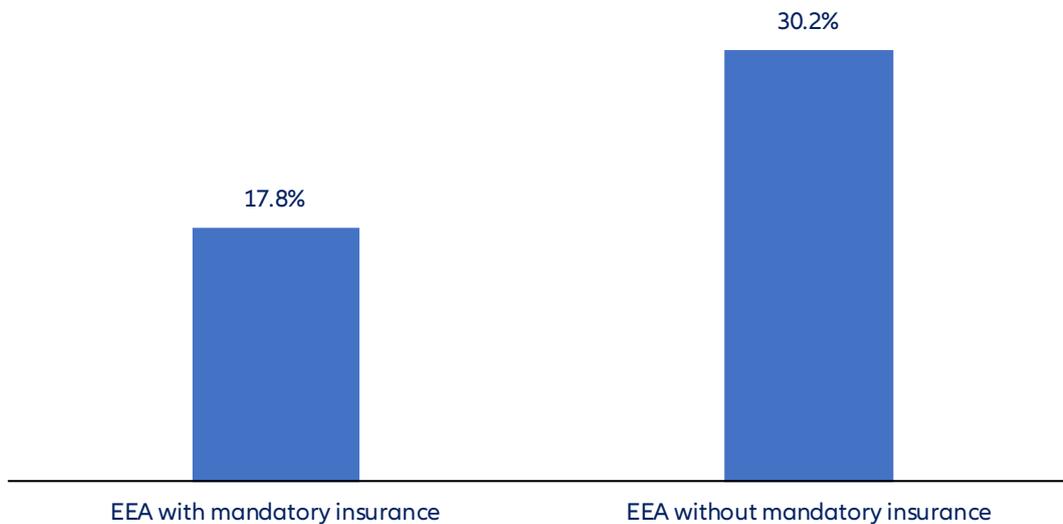


Source: Allianz Research

Expanding insurance coverage through national insurance schemes is a key strategy for enhancing societal resilience to climate-related disasters.

In the European Economic Area (EEA), countries with mandatory insurance schemes tend to have a significantly higher protection, around 30% compared to 18% in countries without such frameworks (Figure 19). These schemes not only increase coverage but also promote risk awareness, incentivize preventive measures and improve the affordability of (re)insurance. By pooling risks across multiple perils and asset classes, national schemes ensure broader financial protection while maintaining long-term stability. A defining characteristic of many national insurance schemes is their public (re)insurance model, which often operates as a complementary system alongside private market solutions. Most of these schemes function on an indemnity basis, meaning payouts are calculated based on actual losses rather than predefined parametric triggers. Risk-based pricing remains the dominant approach, ensuring that premiums reflect exposure levels while still maintaining accessibility. However, many schemes face increasing pressure due to rising reinsurance costs, with affordability emerging as a

growing challenge. While public financing is not always a core design feature, governments play a crucial role in shaping the legal framework and operating conditions necessary for these schemes to function effectively. A successful national insurance scheme requires strong coordination between the public and private sectors (see Box 2 discussing government-sponsored NatCat insurance pools). Private insurers contribute technical expertise, risk modelling and underwriting capacity, while the public sector provides regulatory oversight, policy direction, and financial safeguards where needed. In response to escalating climate risks, new initiatives are emerging to strengthen public-private collaboration in risk identification and prevention. These efforts are essential to ensuring that national insurance schemes remain viable, adaptable and capable of addressing the evolving challenges of climate change.

Figure 19: Insurance gap in the European Economic Area (EEA), 2022 – 2024

Sources: EIOPA, Allianz Research

Remittance-linked insurance presents a promising solution for strengthening climate resilience in developing economies (Figure 18). Remittances act as a critical financial lifeline for millions, particularly in sub-Saharan Africa (SSA), yet they remain highly vulnerable to unexpected shocks (see Box 3). Migrant workers, often employed in the informal sector, lack social protection, while recipients rely on these funds for basic needs, healthcare and business stability. Climate hazards, such as floods, droughts, and cyclones, exacerbate this vulnerability by causing sudden income disruptions, threatening livelihoods and economic stability. By integrating insurance into remittance services, remittance-linked insurance could safeguard both senders and receivers against financial shocks. If a sender faces an unforeseen event, such as job loss, illness or disability, insurance could temporarily cover remittance payments, ensuring recipients continue receiving support. Likewise, if a recipient suffers climate-related losses (e.g., crop failure, property damage or business disruption), insurance could reduce the financial

strain on senders, preventing them from depleting their own resources to compensate for the shortfall. This risk-sharing mechanism enhances household resilience, reduces dependency on emergency loans and stabilizes financial security in climate-exposed communities. To scale this innovative approach, remittance service providers and insurers must collaborate to develop affordable, accessible and regulatory-compliant insurance products tailored to the unique risks faced by migrants and their families. By expanding insurance coverage and unlocking formal remittance flows, remittance-linked insurance can bridge the protection gap, reduce climate vulnerability and create more resilient economies across the developing world.

Box 2: Government-sponsored NatCat insurance pools

Government-sponsored insurance pools (McAneney et al., 2016) play a crucial role in ensuring access to coverage for natural catastrophe risks, particularly in regions where private insurance markets struggle to provide affordable options. These pools are typically designed to stabilize insurance availability, spread risk and reduce the financial burden on households and businesses. By combining public support with private sector involvement, they aim to balance affordability with financial sustainability, ensuring that disaster recovery mechanisms remain effective and resilient. The US provides two notable examples of government-sponsored natural catastrophe (NatCat) insurance pools. Florida's Citizens Property Insurance Corporation and the Florida Hurricane Catastrophe Fund (FHCF) for windstorm risk, and the California Earthquake Authority (CEA) for seismic risk. These initiatives highlight both the strengths and challenges of publicly supported insurance mechanisms in addressing affordability, risk concentration and financial sustainability.

In the late 1960s, Florida faced a severe crisis in property insurance availability, putting homeowners at risk of mortgage default due to the requirement that residential properties be insured. In response, state lawmakers introduced the Florida Windstorm Underwriting Association (FWUA) in 1970, compelling insurers to participate in a state-backed program that provided non-risk-rated coverage for high-risk coastal areas. This balance between affordability and risk exposure remains a challenge for many NatCat insurance pools. Following Hurricane Andrew in 1992, Florida established the Joint Underwriting Association (JUA) as a temporary solution to cover short-term policyholder needs. In 2001, the FWUA and JUA merged to form Citizens Property Insurance Corporation, a tax-exempt entity financed through policyholder premiums, assessments on insurers, government and private securities, and bond issuances. When shortfalls occur, additional policyholder surcharges and emergency assessments are levied. To complement Citizens, Florida created the Florida Hurricane Catastrophe Fund (FHCF) in 1993 to offer low-cost reinsurance for hurricane losses. However, the FHCF concentrates hurricane risk within the state rather than distributing it globally. Although it has started incorporating external risk transfer mechanisms, a significant share of its claims-paying capacity remains tied to state-held cash reserves and bonding.

Unlike Florida, California does not mandate earthquake insurance for mortgage financing. Despite a 1985 regulation requiring insurers to offer earthquake coverage to policyholders, the 1994 Northridge earthquake revealed major gaps in insurance uptake, only about a third of affected homeowners had purchased coverage. Insurers faced claims of USD15bn while having collected just USD3.4bn in premiums over the preceding 25 years. In response, California established the California Earthquake Authority (CEA) in 1996 as a tax-exempt, nonprofit, largely private-sector-funded entity. Insurers could either remain in the market and pay an "exit tax" or transfer funds to the CEA and participate in the pool. Around 70% of insurers chose to join, and the CEA has since relied on premiums, investment returns and transferred insurer contributions to sustain its operations. Unlike Citizens in Florida, the CEA does not have direct government financial backing.

New Zealand has developed a distinct model for insuring against natural disasters, particularly earthquakes, through the Earthquake Commission (EQC) now renamed the Natural Hazards Commission (NHC) to reflect its broader scope of coverage. Unlike California's voluntary earthquake insurance system, NHC provides automatic first-loss coverage for all policyholders with residential fire insurance. This ensures broad participation and prevents the insurance gap observed in other regions. The system covers a wide range of perils, including earthquakes, tsunamis, landslips, volcanic eruptions and hydrothermal activity, as well as fire damage resulting from these events. NHC's funding mechanism is based on a compulsory levy collected through private insurance policies. Homeowners pay a set premium as part of their fire insurance policy, and insurers transfer the levy to NHC, which then invests it in the Natural Disaster Fund (NDF). This setup ensures that only insured properties receive government-backed coverage, providing a financial safety net while maintaining clear risk-sharing responsibilities.

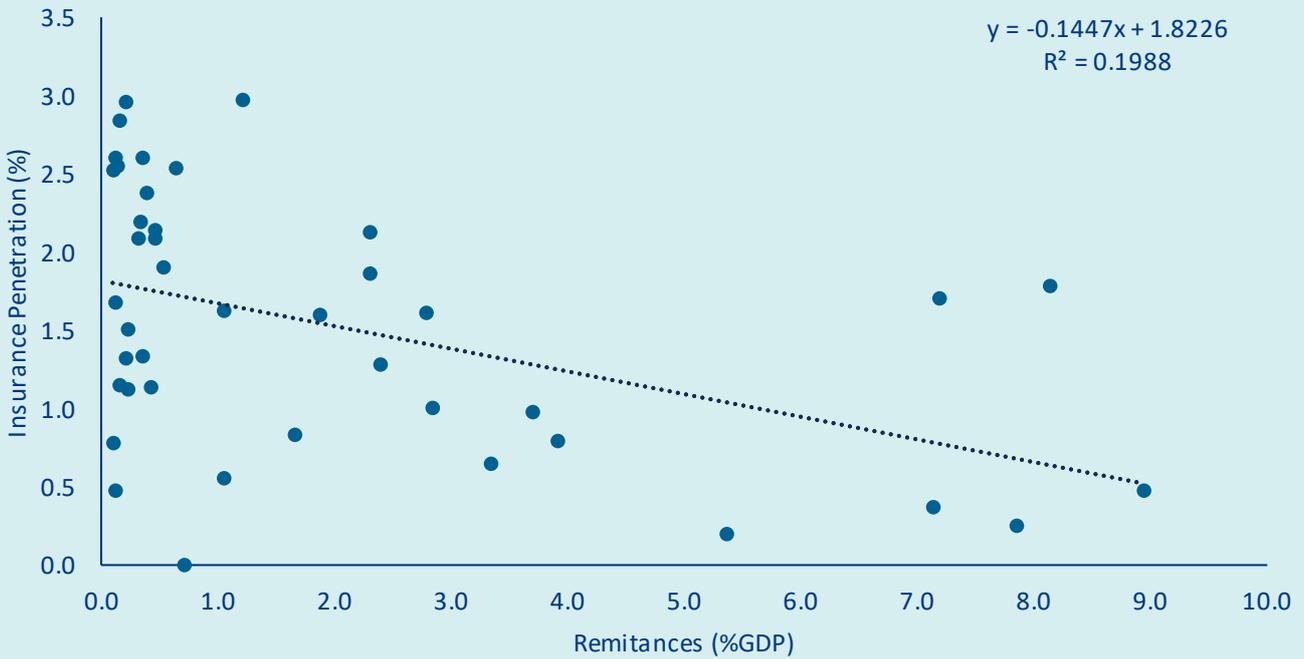
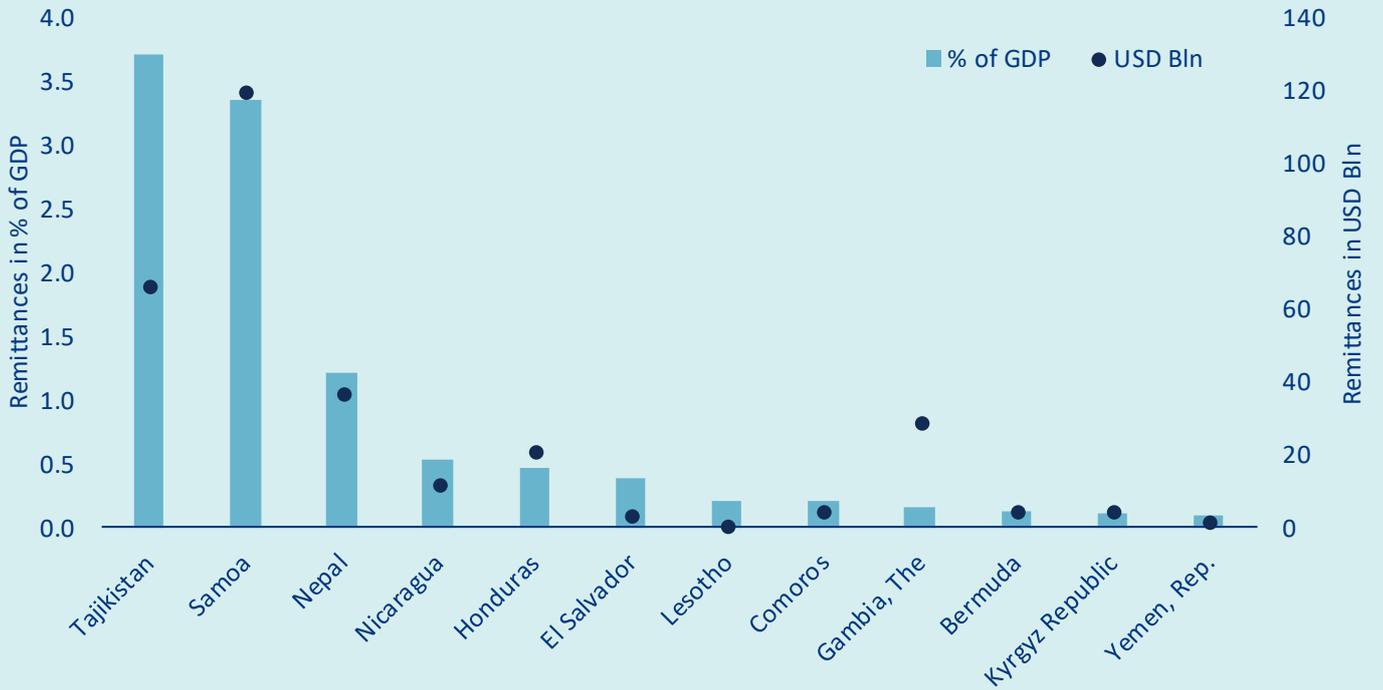
In France, natural catastrophe insurance is integrated into all comprehensive home insurance policies as a mandatory component. Established in 1982, the Caisse Centrale de Réassurance (CCR) operates as a public-private partnership, offering government-backed reinsurance. As part of the NatCat scheme, the CCR was founded on the principle of national solidarity, ensuring universal access to catastrophe insurance at standardized rates set by decree, irrespective of individual risk levels. Private insurers have the flexibility to seek reinsurance either through the state-backed CCR or the private market, though the CCR remains the preferred choice. Under this system, insurers typically cede 50% of their natural peril risks to the CCR, transferring an equivalent share of their natural disaster premiums in a quota-share arrangement, helping to maintain financial stability across the insurance sector.

Box 3: Remittances as a financial lifeline for developing countries

Developing countries with high insurance gaps often rely on remittances as an alternative financial safety net in the aftermath of disasters. Cross-country analyses show that remittances tend to increase following major disasters, particularly in nations with large migrant populations abroad. This flow of funds plays a crucial role in maintaining household consumption and accelerating recovery, serving as an informal yet effective financial cushion where insurance coverage is inadequate. India and Mexico are also among the largest recipients of remittances, with inflows exceeding 3% of GDP (Figure 16a). This pattern suggests a strong inverse correlation between insurance penetration and remittance dependency, where lower insurance coverage is often compensated by higher remittance inflows (Figure 16b). Several factors contribute to this trend, including the significant number of migrants from developing economies supporting their families back home. For example, the global African diaspora consists of approximately 40mn individuals who provide financial assistance to around 200mn family members through remittances. In the absence

of mature and well-regulated insurance markets, many households in these economies turn to informal financial safety nets rather than formal risk management tools such as property and casualty insurance. This reliance on remittances extends beyond disaster recovery and plays a growing role in climate adaptation and financial resilience. In regions highly exposed to climate risks, remittances have emerged as a significant short-term source of income that helps bridge financing gaps for adaptation efforts. In Africa, for instance, remittance flows reached nearly USD100bn in 2022, constituting approximately 6% of the continent's GDP. These numbers far exceeded official development assistance and foreign direct investment, which stood at USD55.5bn. Such financial flows highlight the importance of remittances as a lifeline for vulnerable populations, particularly in countries with weak insurance markets. While remittances provide crucial support in times of crisis, they do not fully replace the need for improved insurance penetration to ensure long-term and stable financial resources in time of stress.

Figure 20: Received remittances by country: a) total received remittances (second axis, USD bn) and remittances as a share of GDP (first axis, %); b) relation between remittances and P&C insurance penetration



Sources: WDI, Allianz Research

A close-up photograph of several hands of different skin tones stacked on top of each other, resting on the rough bark of a tree trunk. The background is a lush green forest with sunlight filtering through the leaves. The text 'Our team' is overlaid on the image.

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