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THE CAPCO INSTITUTE
JOURNAL
OF FINANCIAL TRANSFORMATION

RISKS

Assessing the economic
impact of climate change

JÉRÔME JEAN HAEGELI | PATRICK SANER



INSURANCE

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DEAR READER,

Welcome to edition 54 of the Capco Institute Journal of Financial Transformation.

In this edition we explore recent transformative developments in the insurance industry, through Capco's Global Insurance Survey of consumers in 13 key markets, which highlights that the future of insurance will be personalized, digitalized, and connected. Other important papers cover topics high on global corporate and political agendas, from ESG and climate change to artificial intelligence and regulation.

The insurance industry has been undergoing transformation in recent years, with insurers responding to the needs and expectation of tomorrow's customers, for products that were tailored, flexible, and available anytime, anyplace, and at a competitive price.

COVID-19 has accelerated such change, forcing insurers to immediately implement programs to ensure they can continue selling their products and services in digital environments without face-to-face interaction. New entrants have also spurred innovation, and are reshaping the competitive landscape, through digital transformation.

The contributions in this edition come from a range of world-class experts across industry and academia in our continued effort to curate the very best expertise, independent thinking and strategic insight for a future-focused financial services sector.

As ever, I hope you find the latest edition of the Capco Journal to be engaging and informative.

Thank you to all our contributors and thank you for reading.

A handwritten signature in black ink, appearing to read 'Lance Levy', with a stylized, flowing script.

Lance Levy, Capco CEO

ASSESSING THE ECONOMIC IMPACT OF CLIMATE CHANGE

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PATRICK SANER | Head Macro Strategy, Global Economic Research & Strategy, Swiss Re

ABSTRACT

The extreme weather events seen worldwide this year underline the need for decisive global action on climate change, one of the biggest societal risks of our era. Rising global temperatures and more extreme weather events will increasingly set economies back through physical risks such as property damage, disruption to trade, and lost productivity. There will also be transition costs as we move away from systems and infrastructure underpinned by fossil fuels and carbon-intensive resources. Swiss Re Institute set out to assess how climate risks will impact economic output (GDP) in countries globally. The analysis covers 48 countries representing 90% of the world economy, using global warming of 2.0-2.6°C by mid-century as a baseline scenario. For the economic impact of climate change, the tail of possible economic outcomes is what matters. The research uses a scenario approach to capture uncertainties around temperature paths and economic implications, complementing typical climate risk models that identify the average expected GDP loss. The research also tested countries' resilience by building a model that combines the findings on the economic impact of gradual climate change with countries' vulnerability to extreme weather events and their adaptive capacity.

The research finds that the world stands to lose around 10% of GDP by mid-century if climate change stays on the same trajectory and the Paris Agreement and 2050 net-zero emissions targets are not met. Achieving the Paris Agreement target would reduce the impact, but there would still be a global GDP loss. The extreme weather analysis indicates higher likelihood of droughts in southeast Asia and Latin America, and higher excess precipitation and flooding in northern and eastern Europe. The Swiss Re Institute Climate Economics Index ranking finds that those most negatively impacted by rising global temperatures are often those with fewest resources to adapt to and mitigate the effects. More global, coordinated action to mitigate climate change is an imperative. Swiss Re Institute makes policy recommendations for both the public and private sectors to accelerate climate-related action and collaborate to ensure equitable progress in greening economies.

1. INTRODUCTION

Climate change affects us all. The extreme weather events across Europe and North America this summer were just the latest forewarning of what we might expect from our climate in future. Encouragingly, we see increasingly loud and clear responses in global political and policy spheres. The latest U.N. Intergovernmental Panel on Climate Change (IPCC) report in August issued a "code red" alert for humanity on global warming, while at the June G7 meeting, world leaders pledged to end the use of coal-fired power generation.

Swiss Re Institute analysis finds that the world stands to lose about 10% of total economic value (GDP) by the middle of this century if climate change stays on the same trajectory and the Paris Agreement and 2050 net-zero emissions targets are not met. Rising global temperatures and more extreme weather events will increasingly set economies back through physical risks such as property damage, disruption to trade, and lost productivity.

A green economy is ultimately to everyone’s benefit, and though there will be transition costs as we move away from systems and infrastructure underpinned by fossil fuels and carbon-intensive resources, the ecological and economic cost of doing nothing is even higher. We stress-test how climate risks will impact 48 countries representing 90% of the world economy, and their resilience to change. Our analysis finds that all countries will be affected, but some more than others. No action is not an option.

2. THE ECONOMIC IMPACT OF CLIMATE CHANGE: THE STING IS IN THE TAIL

Models of the economic impact of climate change typically seek to identify the average expected GDP loss. Other than considering effects such as negative feedback loops, most do not account for high-impact disasters such as drought and severe precipitation that can significantly increase the GDP loss.

Climate change research¹ indicates that the trajectory of temperature increases, assuming action with respect to climate change mitigation pledges, points to global warming of 2.0-2.6°C by mid-century. We use this as a baseline to

simulate the impact of rising temperatures, while also taking into account uncertainties around severe possible physical outcomes such as the potential effects of disruption to global trade, migration, and biodiversity. The result, shown in Table 1, is that global GDP would be 11-14% less than in a world without climate change (i.e., 0°C temperature change).

Achieving the Paris Agreement target, of limiting the rise in global temperatures to well below 2°C, would also entail a negative GDP impact, but much smaller (-4.2%). We also consider a severe scenario in which temperatures rise by 3.2°C by mid-century, with society doing nothing to combat climate change. In this scenario, the global economy would be 18% smaller than in a world without warming. The analysis reinforces the imperative need for, if anything, more action on climate change than is already under way.

In economic terms, no country is immune to climate change. Outcomes vary by country based on: 1) where they lie geographically and 2) their economic composition. Countries in the more exposed geographic regions, such as Southeast Asia or Africa, face worse economic outcomes than, for example, those in Northern Europe. Emerging economies often rely more on agriculture and tourism to drive economic growth,

Table 1: Global temperature rises will negatively impact GDP in all regions by mid-century

TEMPERATURE RISE SCENARIO, BY MID-CENTURY	WELL BELOW 2°C INCREASE	2.0°C INCREASE	2.6°C INCREASE	3.2°C INCREASE
	PARIS TARGET	THE LIKELY RANGE OF GLOBAL TEMPERATURE GAINS		SEVERE CASE
SIMULATING FOR SEVERE ECONOMIC IMPACTS FROM CLIMATE CHANGE EFFECTS				
World	-4.2%	-11.0%	-13.9%	-18.1%
OECD	-3.1%	-7.6%	-8.1%	-10.6%
North America	-3.1%	-6.9%	-7.4%	-9.5%
South America	-4.1%	-10.8%	-13.0%	-17.0%
Europe	-2.8%	-7.7%	-8.0%	-10.5%
Middle East and Africa	-4.7%	-14.0%	-21.5%	-27.6%
Asia	-5.5%	-14.9%	-20.4%	-26.5%
Advanced Asia	-3.3%	-9.5%	-11.7%	-15.4%
ASEAN	-4.2%	-17.0%	-29.0%	-37.4%
Oceania	-4.3%	-11.2%	-12.3%	-16.3%

Note: Temperature increases are from pre-industrial times to mid-21st century and from left to right relate to increasing emissions and/or increasing climate sensitivity (reaction of temperatures to emissions). To measure the impact of temperature rise, the economic loss is represented as a percentage of GDP in a world without climate change.

Source: Swiss Re Institute

¹ Intergovernmental Panel on Climate Change (IPCC), 2014. Fifth Assessment Report (AR 5), <https://bit.ly/3ENlpoX>

which are more adversely exposed to significantly higher temperatures. In contrast, more services-orientated advanced economies are more insulated from the direct effects of rising temperatures, albeit not completely.

2.1 The Paris Agreement temperature target is the most desirable outcome

Up to 10% of the GDP loss we expect by mid-century could be prevented if the world meets the Paris Agreement target rather than reaching 2.6°C warming. In more exposed regions, meeting the target could prevent more than 25% of the GDP loss associated with 2.6°C warming. Emerging markets would mitigate a large part of their expected GDP losses, with Indonesia, Thailand, and Saudi Arabia the biggest relative winners.

2.2 Extreme weather events: The physical impacts of climate change

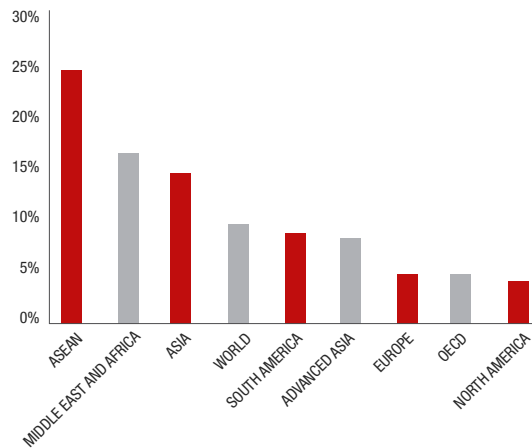
Economies will feel the consequences of more extreme weather events as well as the economic impact of gradually rising temperatures.

We assess the potential outcomes of severe weather events by constructing hazard-based climate risk scores (CRS). On a scale of 1 to 10, these scores reflect the relative exposure of different locations to extreme dry and wet conditions in the environment of gradual climate change.² There are two main dimensions: 1) changes in extreme and mean temperatures (dry scores) and 2) changes to extreme and mean precipitation (wet scores). The two CRS sub-scores are proxies for actual weather-related catastrophes such as wildfires, heat waves, and droughts (dry); and river and flash floods (wet).³

As Figure 2 highlights, rising temperatures will likely cause more drought in Southeast Asia and Latin America. Figure 3 illustrates the likely increase in excess precipitation and flooding events in northern and eastern European countries.

The U.K. is vulnerable to both extreme dry and wet conditions as global temperatures rise over time. For some large countries that span several climate regimes (e.g., Russia, Australia, China), regional disparity also exists given the diversity of locations in each country. For example, in Australia, the southeast is expected to become drier and the north wetter, especially in summer.

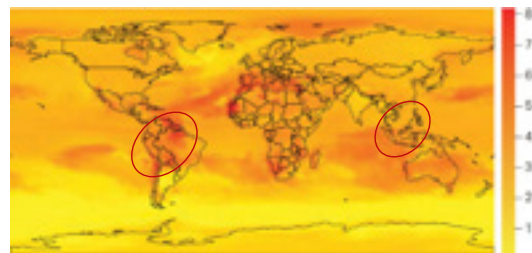
Figure 1: Mitigated GDP loss (in %) by mid-century if Paris Agreement target is met, versus 2.6°C rise scenario



Note: Here, we simulate severe economic impacts from climate change. The figures shown represent the difference between the 2.6°C scenario and the Paris scenario, as % of GDP in a world without climate change.

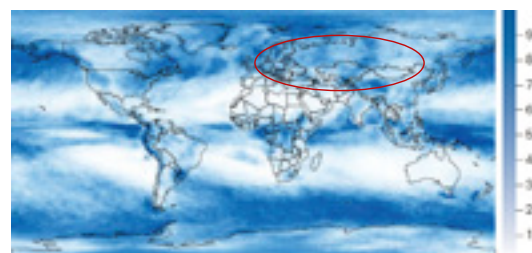
Source: Swiss Re Institute

Figure 2: Dry scores, as of 2030, under RCP8.5 scenario



Source: Swiss Re Institute

Figure 3: Wet scores, as of 2030, under RCP8.5 scenario



Source: Swiss Re Institute

² Lüthi, S., M. Gloor, and M. Walz, "Climate risk score – a framework to quantify an insurance portfolio's exposure and contribution to climate change," EGU General Assembly 2020, Online, 4–8 May 2020, EGU2020-9877, <https://bit.ly/3tZYDFm>

³ The scales of the dry and wet scores assess the hazard risk on a scale from zero (lowest) to 10 (highest) risk.

Table 2: Swiss Re Institute Climate Economics Index, top and bottom five rankings

RANK	COUNTRY	PHYSICAL RISK			CURRENT ADAPTIVE CAPABILITY RANKING**	TOTAL INDEX
		GDP IMPACT RANKING	EXTREME WEATHER RISK RANKINGS*			
			DRY	WET		
1	Finland	3	8	32	8	11.3
2	Switzerland	4	12	37	2	11.6
3	Austria	7	15	41	6	15.1
4	Portugal	9	21	30	10	15.9
5	Canada	12	18	20	16	16.0
44	Thailand	45	43	11	39	36.0
45	India	42	37	13	46	36.4
46	Philippines	46	48	5	43	37.3
47	Malaysia	48	47	23	33	38.3
48	Indonesia	44	45	19	44	39.2

*Extreme weather risk is proxied by Swiss Re Institute's climate risk scores that reflect individual country potential exposures to extreme dry and wet weather conditions/events on account of changes to the climate. **The adaptive capacity rankings are based on the Climate Change Adaptive Capacity Index from Verisk Maplecroft. Our sample analysis covers 48 countries accounting for 91% of global GDP in 2019.

Source: Verisk Maplecroft, Swiss Re Institute

3. CLIMATE CHANGE RESILIENCE: WHICH COUNTRIES ARE GETTING PREPARED?

Both the longer-term economic impact, and the exposure to extreme weather events, offer a good yardstick of the regions and countries likely to be most affected by climate risk. Knowing this, the next questions are: what are countries actually doing to mitigate climate risk, and how resilient are they overall? To provide an indication of resilience to climate risk, we built the Swiss Re Institute Climate Economics Index.

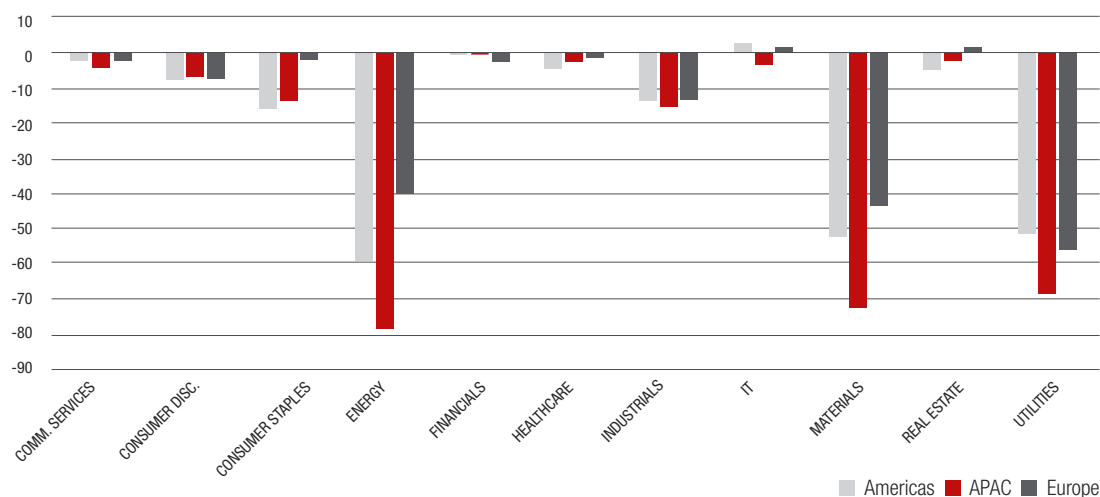
Our index incorporates the economic impact of gradual climate change, countries' vulnerability to extreme wet and dry weather events, and their adaptive capacity. We rank countries according to their 1) estimated GDP impact from an adverse temperature scenario, 2) vulnerability to extreme weather events, and 3) current adaptive capability to climate change. This provides a holistic measure of not only the risks countries face, but also their recognition of these risks and what they are doing about them.

The countries most negatively impacted are often the ones with fewest resources to adapt to and mitigate the effect of rising global temperatures. The index rankings show that many advanced economies in the northern hemisphere are most resilient to the overall effects of climate change, being

both less exposed to the associated risks and better resourced to counter its effects. The U.S., Canada, and Germany are among the top 10 least vulnerable. Many emerging markets, which will make an increasing contribution to global growth in the future, are both heavily exposed and poorly resourced to adapt. Economies in Southeast Asia are particularly vulnerable to adverse effects of climate change. China ranks lower among the major economies, in part due to less adaptive capacity in place today relative to peers. However, with rising investment in green energy and awareness of climate risks, China is on course to catch up rapidly.

4. FALLING ASSET VALUES AND HIGHER BUSINESS COSTS: THE FINANCIAL IMPACTS OF CLIMATE CHANGE

The transition towards a low carbon economy is non-negotiable, but it has repercussions for asset valuations. Climate change gives rise to transition risks that can be seen, for example, in large shifts in asset values and higher cost of doing business as the world moves to a low-carbon economy. As a separate analysis, we use carbon-tax scenario analysis as a proxy to gauge the associated financial and economic impacts (see Figure 4).

Figure 4: Transition risk by economic sector and global region

Source: Blackrock Carbon Tax Impact Mode, Swiss Re Institute

It is clear that climate transition risks can have a substantial impact on equity and credit valuations. We find that earnings in the utilities, materials, and energy sectors would be the most impacted and lose between 40-80% of their earnings per share by the immediate imposition of a global carbon tax of U.S.\$100 per metric ton. Regionally, Asia is again most exposed. Revenue-weighted earnings would fall by about a fifth in Asia Pacific, compared with 15% in the Americas and Europe. The timing and scope of policy decisions will influence the severity of asset value changes. The scale of loss depends on the speed at which carbon taxes and mitigation actions are implemented, and the pace of technological adoption.

5. WE HAVE THE VISION; WHAT WE NEED IS MORE EXECUTION

Most societies do not need to be sold on the vision of a greener economy: we all stand to benefit from a more predictable, sustainable future as much as we stand to suffer from a worse one. Many countries and companies already have net-zero targets in place. However, progress has been too slow. Climate change mitigation strategies should not be viewed as optional – nor should time and money spent be seen as a cost. It is an investment in the future. For example, the International Energy Agency estimates that roughly 9 million jobs a year will be created or saved if we were to commit a global annual investment of U.S.\$1 trillion to the green economy between

now and 2023.⁴ That is only about 0.7% of current global GDP. It would also add 1.1 percentage points to economic growth, essentially paying for itself. Similarly, several studies suggest that the impact on consumer prices should be negligible.

The Paris Climate Agreement commitments share a common goal to work towards, but each signatory is following its own elected route, and progress around the world has been faltering. Pockets of innovation are encouraging, and many countries can point to examples of action in individual cities or sectors. Still, the impetus and direction to scale up projects and achieve outcomes that reverse the relentless march of carbon emissions are lacking.

Climate change is a global risk that requires global coordinated policy action to ensure equitable progress in greening economies, both for local benefit and to make the world economy more resilient in the long term. More action to mitigate climate change is an imperative. Both public and private sectors need to accelerate climate-related policy action and collaborate. Long-term tail risks need to be managed through coordinated global action, including via smart public-private investment into green infrastructure. Coordination between the top three global CO₂ emitters (China 28%, U.S. 15%, and India 7%), which together account for roughly half of all emissions, is crucial.⁵ We see the following as key areas to mitigate the worst-case climate outcomes:

⁴ IEA, 2020, "IEA offers world governments a sustainable recovery plan to boost economic growth, create millions of jobs and put emissions into structural decline," International Energy Agency, Press Release, June 18, <https://bit.ly/3AsBZry>

⁵ Statista, 2020, "Largest producers of fossil fuel CO₂ emissions worldwide in 2018, by share of emissions," September 7, <https://bit.ly/3ksg6Dd>

Public sector

- **Meaningful carbon pricing:** a global carbon tax that supports long-term decision-making also supports the net zero transition. A carbon tax would, with increased familiarity and understanding, help promote more transparent pricing of climate-related financial risks and reflects this within financial markets.
- **Fiscal incentives for carbon capture and reduction and climate-resilient development:** tax incentives could encourage business to invest in carbon capture and GHG-emission reduction technologies. This could also lead to more research into and development of these areas and enable more finance flows towards climate-resilient development.
- **Transparency and standardization around taxonomy, data, standards, and metrics:** for example, the taxonomy around what is “green” and “sustainable” should be universal. Shared standards, allowing for some regional variation, are key for carbon price discovery and would strengthen comparability of corporate reporting.

Private sector

- **Begin practicing net-zero carbon emissions:** by joining the United Nation's Net Zero Asset Owner Alliance, institutional investors, including insurers, can deliver a bold commitment to transition their portfolios to net-zero GHG emissions by 2050. Insurers should consider deploying sustainable underwriting practices.
- **Corporations should disclose transition plans:** companies should show through transition plans how their business is future-proof and consistent with a net-zero carbon economy. Such transition plans should also feature interim updates of how to achieve longer-term goals.
- **Rating agencies should more explicitly take climate change into account:** climate change has financial implications, which rating agencies should take into account when assessing sovereign and corporate balance sheets in their rating methodology. They can play a key role in shaping best practice of what constitutes a “good climate” rating, to avoid “greenwashing” of capital flows.

Importantly, the transition to a low carbon economy is a collective learning journey. All participants should share risk knowledge and expertise. For example, the private sector, particularly re/insurance companies, can share expertise around risk models and new technologies to better understand and mitigate the effects of climate change and natural catastrophes.

6. CONCLUSION AND THE PATH FORWARD

Climate risk is potentially the biggest societal risk of our era. We believe it must be addressed through coordinated global policy action. Our scenario analysis estimates that in a severe, unmitigated climate-change scenario, global GDP could be 18% less by mid-century compared to a no-climate change world. Our motivation is not to be alarmist but to profile the severity of potential risks, including of tail exposures, if society does nothing about climate change. No country is immune to the effects of climate change, and no action is not an option. Many major economies would lose roughly 10% of their GDP in about 30 years' time, while some in southeast Asia could lose roughly half of their GDP in that timeframe.

We have a unique opportunity to green our economies. The public and private sectors, including insurers as providers of risk transfer capacity, risk knowledge, and long-term investment, can facilitate transition to a low-carbon economy. Increasing transparency, data, and disclosure to price and transfer risks is needed. To this end we should see more policy action on carbon pricing coupled with incentivizing nature-based and CO₂-offsetting solutions. International convergence on the taxonomy on what green and sustainable investments are is also needed. Institutions should also regularly disclose their roadmaps on how they intend to reach the Paris Agreement and 2050 net-zero emissions targets.

At Swiss Re, we have identified four key pillars where systemic intervention is needed: reduce direct emissions and decarbonize all of our business, support carbon removal through industrial pathways, expand and secure carbon removal via natural pathways, and adapt to and minimize consequences from the irreversible climate damage already locked in.

The pandemic has clearly been a great shock to society and the global economy, but it pales in comparison to the long-term impact of climate change. As with the pandemic, no country will be immune to its physical and economic consequences; the urgency and global coordination seen in the battle against the coronavirus needs to underpin the efforts to curb carbon emissions. A science-informed, globally orchestrated, and timely response strategy is the key factor to succeeding in combatting and adapting to climate change.

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