



BANK OF ENGLAND

Speech

Breaking the Tragedy of the Horizon – climate change and financial stability

Speech given by

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I'm grateful to Lloyd's for the invitation to speak tonight on the occasion of the first City Dinner held in this magnificent, eponymous "Room".

Lloyd's is the bedrock of the UK insurance industry.

An industry whose direct contribution to the UK economy is impressive: 300,000 high-paying jobs and £25bn in annual GDP.

Its economic contribution goes much deeper.

Insurance supports households, companies and investors, safeguarding them from perils they could not otherwise shoulder.

It matches long-term savings and investment, financing the infrastructure essential to productivity. With its unique perspective and skill set, insurance diversifies the financial system and reinforces its resilience.

Since 1688 Lloyd's has, in the great tradition of the City, served both the UK and the world, providing protection against the perils of the age; helping enterprise and trade to thrive.

From its origins in marine insurance, the Lloyd's market has evolved constantly to meet the needs of a rapidly changing world.

The first excess of loss reinsurance was created here.

Modern catastrophe cover was born with your decision to stand by policyholders after the San Francisco earthquake.

And Lloyd's pioneered aviation insurance.¹

With eyes constantly on the horizon, Lloyd's has remained at the forefront of global insurance.

Today, you are insuring new classes of risk in new parts of the world – from cyber to climate, from space to specie, from Curitiba to Chengdu.

And you are doing so in market conditions as challenging as any in the last 20 years.

¹ The first aviation policy was written in 1911, followed in 1919 by the founding of the British Aviation Insurance Association. That venture closed in 1921, with underwriters concluding that *'there seems to be no immediate future in aviation insurance...'* www.lloyds.com/lloyds/about-us/history/innovation-and-unusual-risks/pioneers-of-travel.

The need to manage emerging, mega risks is as important as ever.

Alongside major technological, demographic and political shifts, our very world is changing. Shifts in our climate bring potentially profound implications for insurers, financial stability and the economy.

I will focus on those risks from climate change this evening.

The tragedy of the horizon

There is a growing international consensus that climate change is unequivocal.²

Many of the changes in our world since the 1950s are without precedent: not merely over decades but over millennia.

Research tells us with a high degree of confidence that:

- In the Northern Hemisphere the last 30 years have been the warmest since Anglo-Saxon times; indeed, eight of the ten warmest years on record in the UK have occurred since 2002;³
- Atmospheric concentrations of greenhouse gases are at levels not seen in 800,000 years; and
- The rate of sea level rise is quicker now than at any time over the last 2 millennia.⁴

Evidence is mounting of man's role in climate change. Human drivers are judged extremely likely to have been the dominant cause of global warming since the mid-20th century.⁵ While natural fluctuations may mask it temporarily, the underlying human-induced warming trend of two-tenths of a degree per decade has continued unabated since the 1970s.⁶

While there is always room for scientific disagreement about climate change (as there is with any scientific issue) I have found that insurers are amongst the most determined advocates for tackling it sooner rather than later. And little wonder. While others have been debating the theory, you have been dealing with the reality:

- Since the 1980s the number of registered weather-related loss events has tripled; and

² For instance, the IPCC has stated "*Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia*". See IPCC - Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (2014).

³ See www.metoffice.gov.uk/news/releases/archive/2015/Record-UK-temps-2014.

⁴ See IPCC (2014).

⁵ See IPCC (2014) which notes that the effects of anthropogenic greenhouse gas emissions, together with other anthropogenic drivers are "*extremely likely to have been the dominant cause of observed [global] warming since the mid-20th Century*".

⁶ See, for example, Otto et al (2015).

- Inflation-adjusted insurance losses from these events have increased from an annual average of around \$10bn in the 1980s to around \$50bn over the past decade.⁷

The challenges currently posed by climate change pale in significance compared with what might come. The far-sighted amongst you are anticipating broader global impacts on property, migration and political stability, as well as food and water security.⁸

So why isn't more being done to address it?

A classic problem in environmental economics is the tragedy of the commons. The solution to it lies in property rights and supply management.

Climate change is the Tragedy of the *Horizon*.

We don't need an army of actuaries to tell us that the catastrophic impacts of climate change will be felt beyond the traditional horizons of most actors – imposing a cost on future generations that the current generation has no direct incentive to fix.

That means beyond:

- the **business cycle**;⁹
- the **political cycle**; and
- the **horizon of technocratic authorities**, like central banks, who are bound by their mandates.

The horizon for monetary policy extends out to 2-3 years. For financial stability it is a bit longer, but typically only to the outer boundaries of the credit cycle – about a decade.¹⁰

In other words, once climate change becomes a defining issue for financial stability, it may already be too late.

⁷ See Munich Re, NatCatSERVICE (2015).

⁸ The report '*Risky Business – the economic risks of climate change in the United States*' (2014) suggests that in the USA \$238-507bn worth of coastal property could be below sea level by 2100. Research by Lloyd's identifies climate change as an important supply-side issue for food security. See www.lloyds.com/~media/lloyds/reports/emerging%20risk%20reports/food%20report.pdf. This is consistent with the views expressed by Lloyd's market participants surveyed by the PRA for its report to Defra.

⁹ Few business leaders list climate change as a near-term pressing risk. See, for instance, PWC's annual survey of CEOs (www.pwc.com/gx/en/ceo-agenda/ceo-survey.html) and the Bank of England's Systemic Risk Survey (www.bankofengland.co.uk/publications/Documents/other/srs/srs2015h1.pdf).

¹⁰ Even credit ratings typically only look out to 3-5 years.

This paradox is deeper, as Lord Stern and others have amply demonstrated. As risks are a function of cumulative emissions, earlier action will mean less costly adjustment.¹¹

The desirability of restricting climate change to 2 degrees above pre-industrial levels¹² leads to the notion of a carbon 'budget', an assessment of the amount of emissions the world can 'afford'.

Such a budget - like the one produced by the IPCC¹³ - highlights the consequences of inaction today for the scale of reaction required tomorrow.

These actions will be influenced by policy choices that are rightly the responsibility of elected governments, advised by scientific experts. In ten weeks representatives of 196 countries will gather in Paris at the COP21 summit to consider the world's response to climate change. It is governments who must choose whether, and how, to pursue that 2 degree world.

And the role of finance? Earlier this year, G20 Finance Ministers asked the Financial Stability Board to consider how the financial sector could take account of the risks climate change poses to our financial system.

As Chair of the FSB I hosted a meeting last week where the private and public sectors discussed the current and prospective financial stability risks from climate change and what might be done to mitigate them. I want to share some thoughts on the way forward after providing some context beginning with lessons from the insurance sector.

Climate change and financial stability

There are three broad channels through which climate change can affect financial stability:

- First, **physical risks**: the impacts today on insurance liabilities and the value of financial assets that arise from climate- and weather-related events, such as floods and storms that damage property or disrupt trade;

¹¹ For instance, IPCC (2014) Conclusion SPM 2.1 notes that "*cumulative emissions of CO2 largely determine global mean surface warming by the late 21st century and beyond*". The Stern review observes that "*many greenhouse gases, including carbon dioxide, stay in the atmosphere for more than a century*" (See The Stern Review of the Economic Effects of Climate Change (2006)).

¹² The Cancun Agreement in 2010 committed governments to "*hold the increase in global average temperature below two degrees*". Discussion of this level has been attributed to Nordhaus (1975). Others, including the UNEP Advisory Group on Greenhouse Gases (1990) have suggested that two degrees could be a point beyond which the damage caused by climate change may become non-linear.

¹³ See IPCC (2014).

- Second, **liability risks**: the impacts that could arise tomorrow if parties who have suffered loss or damage from the effects of climate change seek compensation from those they hold responsible. Such claims could come decades in the future, but have the potential to hit carbon extractors and emitters – and, if they have liability cover, their insurers – the hardest;
- Finally, **transition risks**: the financial risks which could result from the process of adjustment towards a lower-carbon economy. Changes in policy, technology and physical risks could prompt a reassessment of the value of a large range of assets as costs and opportunities become apparent.

The speed at which such re-pricing occurs is uncertain and could be decisive for financial stability. There have already been a few high profile examples of jump-to-distress pricing because of shifts in environmental policy or performance.

Risks to financial stability will be minimised if the transition begins early and follows a predictable path, thereby helping the market anticipate the transition to a 2 degree world.

To draw out these crucial points consider the Bank of England's current approach to the insurance sector.

As regulator of the world's third largest insurance industry, the PRA is responsible for protecting policyholders and ensuring the safety and soundness of insurers.

Our supervision is forward-looking and judgement-based. It is risk-based and proportionate – tailored to different business models around the sector – and considers both business-as-usual and whether a firm can fail safely – recognising that “zero failure” is neither desirable nor realistic.

Our supervisors take a view of your business plans, risk management, governance, and capital models. Where the PRA judges that it is necessary to intervene it does so sooner rather than later.

While our mandate is to protect policyholders – many of whom are local – we are conscious that international competition needs robust and internationally-consistent regulatory standards.

Solvency II is a good example. It is a prudent but proportionate Directive, that embodies the core principles of our domestic standards and embeds them more consistently across Europe while replacing a patchwork of local regimes.

Another example of how best practice is converging globally is the FSB agreement last week on HLA for global systemic insurers, as well as its support for the IASB completing its new insurance contracts standard. The UK insurance industry is well-prepared for such developments.

Forward-looking regulators consider not just the here and now, but emerging vulnerabilities and their impact on business models.

That is why the PRA has worked with regulated firms, many of them represented here tonight, to produce for the Department for Environment, Food and Rural Affairs a review – published today – into the impact of climate change on British insurers.

The Report concludes that insurers stand exposed to each of the three types of risk climate change poses to finance; and while the sector is well-placed to respond in the near-term you should not assume your ability to manage risks today means the future is secure. Longer term risks could have severe impacts on you and your policyholders.

The insurance response to climate change

It stands to reason that general insurers are the most directly exposed to such losses.

Potential increases in the frequency or severity of extreme weather events driven by climate change could mean longer and stronger heat waves; the intensification of droughts; and a greater number of severe storms.

Despite winter 2014 being England's wettest since the time of King George III; forecasts suggest we can expect at least a further 10% increase in rainfall during future winters.¹⁴

A prospect guaranteed to dampen the spirits and shoes of those who equate climate change with global warming.

While the attribution of increases in claims to specific factors is complex, the **direct costs** of climate change are already affecting insurers' underwriting strategies and accounts.

For example, work done here at Lloyd's of London estimated that the 20cm rise in sea-level at the tip of Manhattan since the 1950s, when all other factors are held constant, increased insured losses from Superstorm Sandy by 30% in New York alone.¹⁵

Beyond these direct costs, there is an upward trend in losses that arise indirectly through second-order events like the disruption of global supply chains.

¹⁴ See Met Office research into climate observations, projections and impacts - <http://www.metoffice.gov.uk/media/pdf/t/r/UK.pdf>.

¹⁵ A Lloyd's report ("*Catastrophe Modelling and Climate Change*" - 2014) looks at factors that influence the impact of hurricanes. It notes the importance of sea-level changes – in addition to wind speed and tides – in the impact of Sandy on New York. See www.lloyds.com/~media/Lloyds/Reports/Emerging%20Risk%20Reports/CC%20and%20modelling%20template%20V6.pdf.

Insurers are therefore amongst those with the greatest incentives to understand and tackle climate change in the short term. Your motives are sharpened by commercial concern as capitalists and by moral considerations as global citizens. And your response is at the cutting edge of the understanding and management of risks arising from climate change.

Lloyd's underwriters were the first to use storm records to mesh natural science with finance in order to analyse changing weather patterns. Events like Hurricanes Andrew, Katrina and Ike have helped advance catastrophe risk modelling and provisioning.¹⁶ Today Lloyd's underwriters are required to consider climate change explicitly in their business plans and underwriting models.

Your genius has been to recognise that past is not prologue and that the catastrophic norms of the future can be seen in the tail risks of today.

For example, by holding capital at a one in 200 year risk appetite, UK insurers withstood the events of 2011, one of the worst years on record for insurance losses. Your models were validated, claims were paid, and solvency was maintained.

The combination of your forecasting models, a forward-looking capital regime and business models built around short-term policies means general insurers are well-placed to manage physical risks in the near term.

But further ahead, increasing levels of physical risk due to climate change could present significant challenges to general insurance business models.

Improvements in risk modelling must be unrelenting as loss frequency and severity shifts with:

- Insurance extending into new markets not covered by existing models;
- Previously unanticipated risks coming to the fore; and
- Increasingly volatile weather trends and hydrological cycles making the future ever-harder to predict.

For example, the extent to which European windstorms occur in clusters¹⁷ could increase the frequency of catastrophes and reduce diversification benefits.

¹⁶ As the PRA's report to Defra notes, major catastrophe events have often driven innovations in risk management. For example, following Hurricane Andrew (1992, \$15.5 billion uninflated insured losses) and the associated insolvency of eight insurance companies, the industry developed a more sophisticated approach to assessing catastrophe risk, and became more resilient to similar events.

¹⁷ Discussions on correlation are not new. For example, a current issue is the extent to which European windstorms occur in clusters, such as windstorms Daria, Vivian, Wiebke and Herta in 1990 and Lothar, Martin, and Anatol in 1999.

Indeed, there are some estimates that currently modelled losses could be undervalued by as much as 50% if recent weather trends were to prove representative of the new normal.¹⁸ In addition, climate change could prompt increased morbidity and mortality from disease or pandemics.

Such developments have the potential to shift the balance between premiums and claims significantly, and render currently lucrative business non-viable.

Absent actions to mitigate climate change, policyholders will also feel the impact as pricing adjusts and cover is withdrawn.¹⁹

Insurers' rational responses to physical risks can have very real consequences and pose acute public policy problems.

In some extreme cases, householders in the Caribbean have found storm patterns render them unable to get private cover, prompting mortgage lending to dry up, values to collapse and neighbourhoods to become abandoned.

Thankfully these cases are rare. But the recognition of the potential impact of such risks has prompted a publicly-backed scheme in the UK – Flood Re – to ensure access to affordable flood insurance for half a million homes now considered to be at the highest risk of devastating flooding.

This example underlines a wider point. While the insurance industry is well placed to adapt to a changing climate in the short-term, their response could pose wider issues for society, including whether to nationalise risk.

The passage of time may also reveal risks that even the most advanced models are not able to predict, such as third party liability risks.

Participants in the Lloyd's market know all too well that what appear to be low probability risks can evolve into large and unforeseen costs over a longer timescale.

Claims on third-party liability insurance – in classes like public liability, directors' and officers' and professional indemnity - could be brought if those who have suffered losses show that insured parties have failed to mitigate risks to the climate; failed to account for the damage they cause to the environment; or failed to comply with regulations.

¹⁸ See Standard and Poor's – '*Climate Change Could Sting Reinsurers That Underestimate Its Impact*' (2014).

¹⁹ In 1992 after Hurricanes Andrew and Iniki hit the US, the price of reinsuring weather risks spiked and several carriers left the market, leading to a rise of up to 40% in premiums in some parts of Florida. A series of hurricanes affecting the Bahamas has prompted several insurers to withdraw flood cover for low-lying areas.

Asbestos alone is expected to cost insurers \$85bn on a net ultimate claims basis in the United States – equivalent to almost three Superstorm Sandy-sized loss events.²⁰

It would be premature to draw too close an analogy with climate risks, and it is true that court cases have, so far, largely been unsuccessful.

Cases like Arch Coal and Peabody Energy – where it is alleged that the directors of corporate pension schemes failed in their fiduciary duties by not considering financial risks driven at least in part by climate change²¹ – illustrate the potential for long-tail risks to be significant, uncertain and non-linear.

And ‘Loss and Damage’ from climate change – and what to do about it – is now formally on the agenda of the United Nations Framework Convention on Climate Change, with some talking openly about the case for compensation.²²

These risks will only increase as the science and evidence of climate change hardens.

Physical risks from climate change will also become increasingly relevant to the **asset side** of insurer’s balance sheets.²³

While the ability to re-price or withdraw cover mitigates some risk to an insurer, as climate change progresses, insurers need to be wary of cognitive dissonance within their organisations whereby prudent decisions by underwriters lead to falls in the value of properties held by the firm’s asset managers. This highlights the transition risk from climate change.

Transition risks

The UK insurance sector manages almost £2tn in assets to match liabilities that often span decades. While a given physical manifestation of climate change – a flood or storm – may not directly affect a corporate bond’s value, policy action to promote the transition towards a low-carbon economy could spark a fundamental reassessment.

Take, for example, the IPCC’s estimate of a carbon budget that would likely limit global temperature rises to 2 degrees above pre-industrial levels.

²⁰ See AM Best – *Special Report: Asbestos Losses Fueled by Rising Number of Lung Cancer Cases* (2013) www.ambest.com/ambv/bestnews/presscontent.aspx?altsrc=0&refnum=20451.

²¹ See *Roe v Arch Coal Inc et al*, Case: 4:15-cv-00910-NAB, United States District Court, Eastern District of Missouri, 9 June 2015 and *Lynn v Peabody Energy Corporation et al*, Case: 4:15-cv-00916-AGF, United States District Court, Eastern District of Missouri, 11 June 2015. Note that as at 1 September 2015 the defences to these claims were yet to be filed.

²² Loss and damage refers to impact of climate change not mitigated by reductions in emissions. The UNFCCC Warsaw agreement in 2013 discussed support for measures to address loss and damage. See <http://unfccc.int/resource/docs/2013/cop19/eng/10a01.pdf>.

²³ The largest UK insurers hold or manage in excess of £40bn of CRE and infrastructure assets, and have committed to further such investments in future. For instance, six major insurers pledged to invest £25bn into UK domestic infrastructure in 2013 as part of the Government’s national infrastructure plan (see <http://www.ft.com/cms/s/0/1f74e176-5c41-11e3-b4f3-00144feabdc0.html>).

That budget amounts to between 1/5th and 1/3rd world's proven reserves of oil, gas and coal.²⁴

If that estimate is even approximately correct it would render the vast majority of reserves “stranded” – oil, gas and coal that will be literally unburnable without expensive carbon capture technology, which itself alters fossil fuel economics.²⁵

The exposure of UK investors, including insurance companies, to these shifts is potentially huge.

19% of FTSE 100 companies are in natural resource and extraction sectors; and a further 11% by value are in power utilities, chemicals, construction and industrial goods sectors. Globally, these two tiers of companies between them account for around one third of equity and fixed income assets.

On the other hand, financing the de-carbonisation of our economy is a major opportunity for insurers as long-term investors. It implies a sweeping reallocation of resources and a technological revolution, with investment in long-term infrastructure assets at roughly quadruple the present rate.²⁶

For this to happen, “green” finance cannot conceivably remain a niche interest over the medium term.

There are a number of factors which could influence the speed of transition to a low carbon economy including public policy, technology, investor preferences and physical events.

From a regulator's perspective the point is not that a reassessment of values is inherently unwelcome. It is not. Capital should be allocated to reflect fundamentals, including externalities.

But a wholesale reassessment of prospects, especially if it were to occur suddenly, could potentially destabilise markets, spark a pro-cyclical crystallisation of losses and a persistent tightening of financial conditions.

In other words, an abrupt resolution of the tragedy of horizons is in itself a financial stability risk.

The more we invest with foresight; the less we will regret in hindsight.

²⁴ The IPCC gives a range of budgets for future emissions which depends on assumptions about other climate drivers and the level of risk of temperatures going >2 degrees that society is willing to accept. It sets these in the context of existing fossil fuel reserves. See table 2.2 in IPCC (2014).

²⁵ The IPCC makes clear that, without this critical technology, the cost of meeting the two degree goal more than doubles – if it can be achieved at all. Canada is home to the world's first *commercial*-scale CCS plant at Boundary Dam. Other projects rely on government subsidies which can prove unreliable. If companies are relying on CCS to achieve net zero carbon emissions, investors will want to assess how they plan to get there – and who they expect to pay for it.

²⁶ The IPCC estimates that additional investment of US\$ 190-900bn is required annually in the energy sector alone if the rise in average global temperature is to be capped at 2C. www.ipcc.ch/report/ar5/ Mercer estimates that additional cumulative investment in efficiency improvements, renewable energy, biofuels and nuclear, and carbon capture and storage could be in the range of US\$3-5trn by 2030. www.mercer.com/insights/point/2014/climate-change-scenarios-implications-for-strategic-asset-allocation.html

And there are ways to make that more likely.

Financial policy implications

Financial policymakers will not drive the transition to a low-carbon economy. It is not for a central banker to advocate for one policy response over another. That is for governments to decide.

But the risks that I have outlined mean financial policymakers do, however, have a clear interest in ensuring the financial system is resilient to any transition hastened by those decisions, and that it can finance the transition efficiently.

Some have suggested we ought to accelerate the financing of a low carbon economy by adjusting the capital regime for banks and insurers. That is flawed. History shows the danger of attempting to use such changes in prudential rules – designed to protect financial stability – for other ends.

More properly our role can be in developing the frameworks that help the market itself to adjust efficiently.

Any efficient market reaction to climate change risks as well as the technologies and policies to address them must be founded on transparency of information.

A 'market' in the transition to a 2 degree world can be built. It has the potential to pull forward adjustment – but only if information is available and *crucially* if the policy responses of governments and the technological breakthroughs of the private sector are credible.

That is why, following our discussions at the FSB last week, we are considering recommending to the G20 summit that more be done to develop consistent, comparable, reliable and clear disclosure around the carbon intensity of different assets.

Better information to allow investors to take a view

An old adage is that which is measured can be managed.

Information about the carbon intensity of investments allows investors to assess risks to companies' business models and to express their views in the market.

A well-known dictum of macroeconomics is Say's Law: that supply creates demand.

This means that the act of producing new products creates income and profits that ultimately finance the demand for them.

By analogy, a framework for firms to publish information about their climate change footprint, and how they manage their risks and prepare (or not) for a 2 degree world, could encourage a virtuous circle of analyst demand and greater use by investors in their decision making. It would also improve policymaker understanding of the sources of CO2 and corporate preparedness.

A carbon budget – like the one produced by the IPCC – is hugely valuable, but can only really be brought to life by disclosure, giving policymakers the context they need to make choices, and firms and investors the ability to anticipate and respond to those choices.

Given the uncertainties around climate, not everyone will agree. Some might dispute the IPCC's calculations. Others might despair that there will never be financial consequences of burning fossil fuels. Still others could take a view that the stakes make political action inevitable.

The right information allows sceptics and evangelists alike to back their convictions with their capital.

It will reveal how the valuations of companies that produce and use fossil fuels might change over time.

It will expose the likely future cost of doing business, paying for emissions, changing processes to avoid those charges, and tighter regulation.

It will help smooth price adjustments as opinions change, rather than concentrating them at a single climate "Minsky moment".

Crucially, it would also allow feedback between the market and policymaking, making climate policy a bit more like monetary policy.

Policymakers could learn from markets' reactions and refine their stance, with better information allowing more informed reactions, and supporting better policy decisions including on targets and instruments.

A climate disclosure task force

That better information – about the costs, opportunities and risks created by climate change – can promote timely responses is not a new idea.

Much the opposite: there are already nearly 400 initiatives to provide such information.

Existing schemes vary in their status (from laws to voluntary guidance); scope (from greenhouse gas emissions to broader environmental risks); and ambition (from simple disclosure to full explanations of mitigation and divestment strategies).²⁷

In aggregate over 90% of FTSE 100 firms and 80% of Fortune Global 500 firms participate in these various initiatives. For instance, the Carbon Disclosure Project makes available disclosure from 5,000 companies to investment managers responsible for over \$90 trillion of assets.

The existing surfeit of existing schemes and fragmented disclosures means a risk of getting “lost in the right direction”.

In any field, financial, scientific or other, the most effective disclosures are:

- **Consistent** - in scope and objective across the relevant industries and sectors;
- **Comparable** - to allow investors to assess peers and aggregate risks;
- **Reliable** - to ensure users can trust data;
- **Clear** - presented in a way that makes complex information understandable; and
- **Efficient** - minimising costs and burdens while maximising benefits.

Meeting these standards requires coordination, something the G20 and FSB are uniquely placed to provide.

The logical starting point is a co-ordinated assessment of what constitutes effective disclosure, by those who understand what is valuable and feasible.

One idea is to establish an industry-led group, a **Climate Disclosure Task Force**, to design and deliver a voluntary standard for disclosure by those companies that produce or emit carbon.

Companies would disclose not only what they are emitting today, but how they plan their transition to the net-zero world of the future. The G20 – whose member states account for around 85% of global emissions²⁸ – has a unique ability to make this possible.

²⁷ A non-exhaustive list of some of the more prominent initiatives in this space includes the Carbon Standards Disclosure Board, Integrated Reporting, the Carbon Disclosure Project, and the UN Principles for Responsible Investment.

²⁸ See www.pwc.co.uk/assets/pdf/low-carbon-economy-index-2014.pdf

This kind of proposal takes its lead from the FSB's successful catalysing of improved disclosure by the world's largest banks following the financial crisis, via the Enhanced Disclosure Task Force.

The EDTF's recommendations, published in October 2012, were the product of collaboration between banks, analysts and investors. This has given the providers of capital the disclosures they need – specifically how banks manage risks and make profits – in a format that the banks can readily supply.

That shows that private industry can improve disclosure and build market discipline without the need for detailed or costly regulatory interventions.

Like the EDTF, a CDTF could be comprised of private providers of capital, major issuers, accounting firms and rating agencies.

Complementing static disclosures

Static disclosure is a necessary first step. There are two ways its impact could be amplified.

First, governments, potentially sparked by COP21, could complement disclosure by giving guidance on possible carbon price paths.

Such a carbon price *corridor* involves an indicative minimum and maximum price for carbon, calibrated to reflect both price and non-price policy actions, and increasing over time until the price converges towards the level required to offset fully the externality.²⁹

Even if the initial indicative price is set far below the “true” cost of carbon, the price signal itself holds great power. It would link climate exposures to a monetary value and provide a perspective on the potential impacts of future policy changes on asset values and business models.

Second, stress testing could be used to profile the size of the skews from climate change to the returns of various businesses.³⁰

This is another area where insurers are at the cutting edge.

Your capital requirements are based on evaluating the impact of severe but plausible scenarios. You peer into the future, building your defences against a world where extreme events become the norm.

²⁹ For instance, the report of the Canfin-Grandjean Commission (2015) discusses the merits of an indicative price corridor with a maximum and minimum price that can be increased over time. See www.elysee.fr/assets/Report-Commission-Canfin-Grandjean-ENG.pdf

³⁰ These skews could be upside or downside, depending on business model and the point in the transition path.

This stress-testing technology is well-suited to analysing tail risks likely to grow fatter with time, casting light on the future implications of environmental exposures embedded in a wide range of firms and investments.

Stress testing, built off better disclosure and a price corridor, could act as a time machine, shining a light not just on today's risks, but on those that may otherwise lurk in the darkness for years to come.

Conclusion

Our societies face a series of profound environmental and social challenges.

The combination of the weight of scientific evidence and the dynamics of the financial system suggest that, in the fullness of time, climate change will threaten financial resilience and longer-term prosperity.

While there is still time to act, the window of opportunity is finite and shrinking.³¹

Others will need to learn from Lloyd's example in combining data, technology and expert judgment to measure and manage risks.

The December meetings in Paris will work towards plans to curb carbon emissions and encourage the funding of new technologies.

We will need the market to work alongside in order to maximise their impact.

With better information as a foundation, we can build a virtuous circle of better understanding of tomorrow's risks, better pricing for investors, better decisions by policymakers, and a smoother transition to a lower-carbon economy.

By managing what gets measured, we can break the Tragedy of the Horizon.

³¹ Already our failure to act since 2010 has increased the task – since emissions persist – and the pace of de-carbonisation required – for instance see <http://site.thomsonreuters.com/corporate/pdf/global-500-greenhouse-gases-performance-trends-2010-2013.pdf>