

Mark Carney: Resolving the climate paradox

Text of the Arthur Burns Memorial Lecture by Mr Mark Carney, Governor of the Bank of England and Chairman of the Financial Stability Board, Berlin, 22 September 2016.

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I am grateful to Alice Carr, Carsten Jung, Ben Nelson and Iain de Weymarn for their assistance in preparing these remarks.

I. Introduction

It is an honour to give the Arthur Burns Memorial Lecture.

In Arthur Burns' day, financial diplomacy was limited to weighty issues of monetary policy coordination, particularly the search for a new international monetary system following the collapse of Bretton Woods.

Your invitation to discuss climate change is a sign of the broadening of the responsibilities of central banks to include financial as well as monetary stability. It also demonstrates the changing nature of international financial diplomacy. The quest for a renewal of the Bretton Woods treaty, with associated protocols and enforcement mechanisms, has been replaced with the more flexible governance of the G20 and the FSB. These groups gather principals who work together to forge consensus and implement global solutions to common problems.

When I spoke at Lloyd's of London a year ago about the financial stability risks arising from climate change, I, in effect, highlighted two paradoxes.¹

First, the *future will be past*. That is, climate change is a tragedy of the horizon which imposes a cost on future generations that the current one has no direct incentive to fix. The catastrophic impacts of climate change will be felt beyond the traditional horizons of most actors including businesses and central banks. Once climate change becomes a clear and present danger to financial stability it may already be too late to stabilise the atmosphere at two degrees.

The second paradox is that *success is failure*. That is, too rapid a movement towards a low-carbon economy could materially damage financial stability. A wholesale reassessment of prospects, as climate-related risks are re-evaluated, could destabilise markets, spark a pro-cyclical crystallisation of losses and lead to a persistent tightening of financial conditions: a climate Minsky moment.

Resolving these conundrums requires first distinguishing the three channels through which climate change affects financial stability.

The first concerns the **physical risks** that arise from the increased frequency and severity of climate- and weather-related events that damage property and disrupt trade.

At present, general insurers are on the front line.² Thus far, a combination of sophisticated forecasting, a forward-looking European insurance capital regime and business models built around short-term coverage has left insurers relatively well-placed to manage physical risks.³

¹ See Carney (2016), "Breaking the Tragedy of the Horizon – climate change and financial stability", speech given at Lloyd's of London, September 2015.

² While the attribution of increases in claims to specific factors is complex, work done 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. See Lloyd's of London (2014), "Catastrophe Modelling and Climate Change".

³ As described in Prudential Regulation Authority, (2015), "The impact of climate change on the UK insurance sector".

Which is why Warren Buffett can observe that climate change is not a threat to Berkshire Hathaway's insurance business.⁴

Insurers have to update their models constantly and adjust coverage prudently. And in time, growing swathes of our economies could become uninsurable absent public backstops – hardly the prescription for a growing business.⁵

Moreover, if coverage is not maintained, the broader financial system would become increasingly exposed to large and variable physical risks.

With their motives as global citizens sharpened by commercial concerns, insurers have some of the greatest incentives to understand and tackle climate change in the short term. For example, Lloyd's of London underwriters are required to consider climate change explicitly in their business plans and underwriting models. Their genius has been to recognise that past is not prologue and that the catastrophic norms of the future are in the tail risks of today.

With such insights, it is perhaps not surprising that the insurance sector has been particularly active in organising itself to address these existential issues.⁶

The second channel concerns **liability risks**. These stem from parties who have suffered loss from the effects of climate change seeking compensation from those they hold responsible. Such claims could arise well into the future, as the science and evidence of climate change hardens, though some are already taking action against companies on the grounds of failure to disclose the risks posed to their business models by climate change.⁷

The final and most important channel involves **transition risks**, which could result from the 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 but 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.

Tonight, I would like to discuss how building new markets – in climate transition and green finance – can help resolve the tragedy of the horizon. Over the past year, the focus of G20 Leaders and the aegis of the FSB have spurred important progress. The upcoming German presidency of the G20 now has a historic chance to mainstream climate finance and turn risk into opportunity.

To add impetus, there is also a growing macroeconomic case for action. Let me begin with that imperative.

⁴ Buffet noted "insurance policies are customarily written for one year and repriced annually to reflect changing exposures. Increased possibilities of loss translate promptly into increased premiums". See: <http://www.berkshirehathaway.com/letters/letters.html>.

⁵ The report '*Risky Business – the economic risks of climate change in the United States*' (2014) suggests that in the USA \$238–507 billion worth of coastal property could be below sea level by 2100.

⁶ The Insurance Development Forum was formed in 2015 as a public-private partnership between the United Nations Development Programme, the World Bank and the insurance sector to use the industry's expertise to insure people in developing countries who are unprotected but vulnerable to climate change risk. This protection gap currently represents 90% of the economic costs of natural disasters that are uninsured.

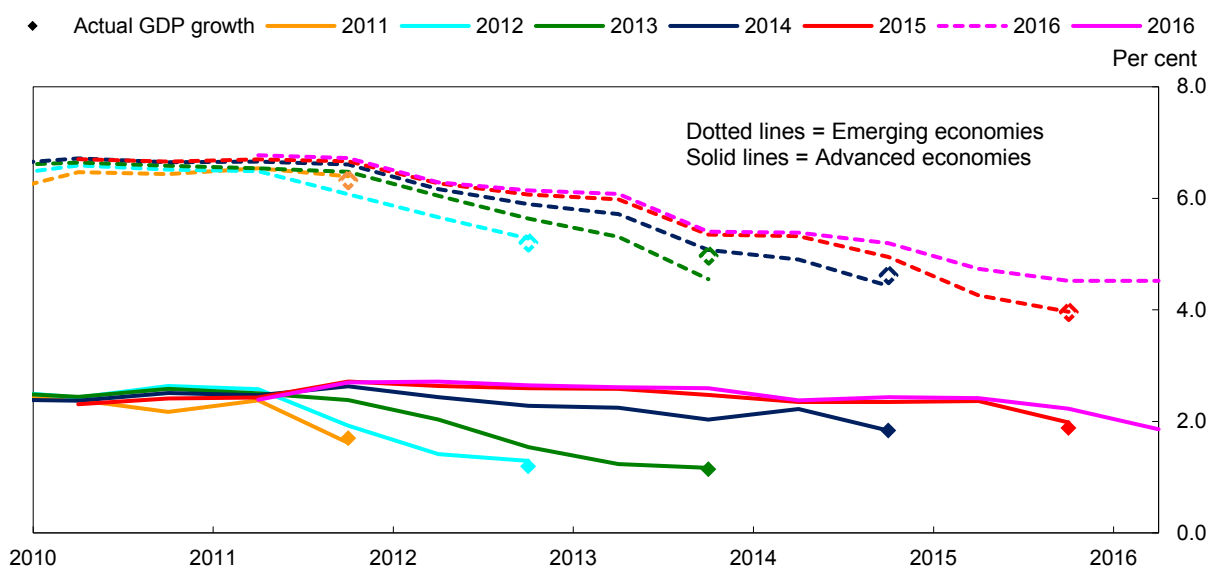
⁷ In late 2015, the New York Attorney General launched an investigation into allegedly insufficient disclosure of climate change risk by a large energy company; Attorneys General in numerous US states have since joined this investigation or launched their own.

II. The macroeconomic imperative

Throughout this decade, global growth has serially disappointed as the combination of huge debt overhangs, profound demographic changes and enormous uncertainties have weighed on activity (**Chart 1**).⁸ Nominal growth in the euro area, the UK and globally, is running at half of its pre-crisis rate.

Chart 1

Consistent downward revisions to GDP growth forecasts



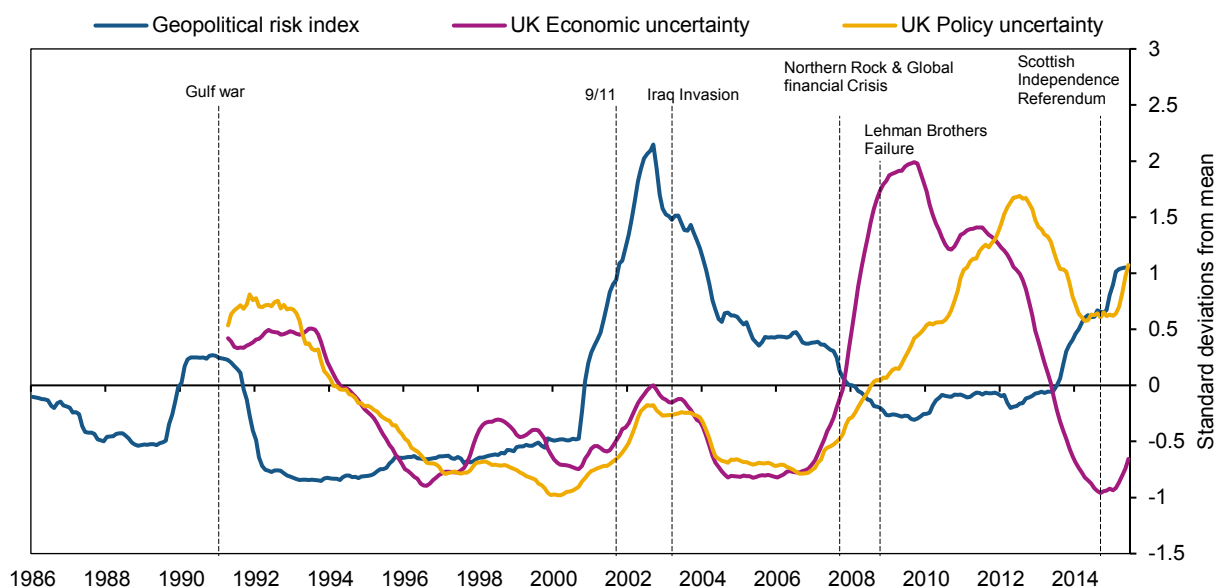
Source: IMF World Economic Outlook. Each line shows how forecasts for a particular calendar year have evolved over time. The diamond shows the eventual outcome.

Growth has been weak despite significant progress repairing the financial system, recent moves to somewhat expansionary fiscal policies in a number of countries, and of course, years of unprecedented monetary policies.

⁸ See Carney (2016), "Uncertainty, the economy and policy", speech given at the Court Room, Bank of England, June 2016.

Chart 2

Three eras of uncertainty: geopolitical, economic and policy



Source: Bank calculations and Caldara and Iacoviello (2016), Baker et al (2015), and Haddow et al (2013). Economic policy and geopolitical uncertainty indices are de-measured and shown relative to their respective standard deviations. Chart shows two-year centred moving average for each measure. See Caldara, D and Iacoviello, M (2016), “Measuring geopolitical risk”, Federal Reserve Board, mimeo; Baker, S, Bloom, N and Davis, S (2015), “Measuring economic policy uncertainty”, NBER Working Paper No. 21633, October; Haddow, A, Hare, C, Hooley, J and Shakir, T (2013) “Macroeconomic uncertainty: what is it, how can we measure it and why does it matter?”, Bank of England Quarterly Bulletin, Q2.

Further restraining growth is a deep risk aversion amongst businesses and investors stemming from a combination of elevated geopolitical, economic and policy uncertainties (**Chart 2**).

This has particularly affected business investment. Across advanced economies, investment has fallen by more than 2½ percentage points of GDP (**Chart 3**), creating substantial investment shortfalls, relative to pre-crisis trends, of around 20% in Germany and 25% in the UK and US (**Chart 4**).

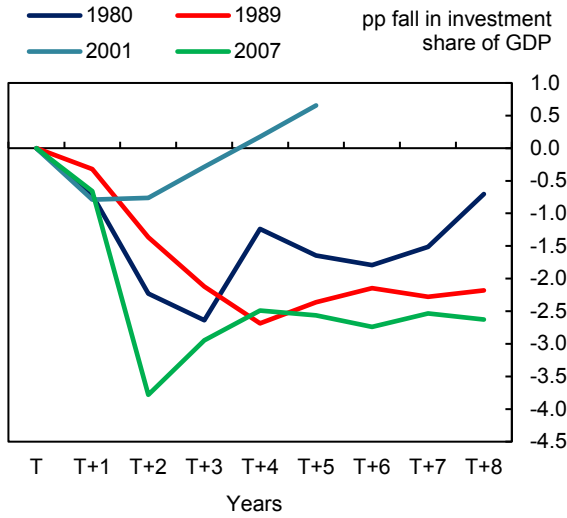
In financial markets, despite a recovery in equities in recent years, equity risk premia are unusually high and government bond yields are consistent with very low growth for a very long time (**Chart 5**).⁹

In short, both business and investors appear to be hedging future disaster risk.

⁹ In the UK and Germany, real interest rates are negative as far as the eye can see. Even in the US, real 30-year rates are well below 1%. Low bond yields suggest that market is discounting low future growth, accounting for some of the wedge between those yields and equity dividend yields. Indeed, year in, year out, earnings forecasts have proven wildly optimistic. However, risk premia are also likely playing a role. Put simply, investors are not only less optimistic about future growth, but are also less certain about that subdued outlook. They are demanding a discount on risky assets to compensate, and seeking risk-free assets instead.

Chart 3

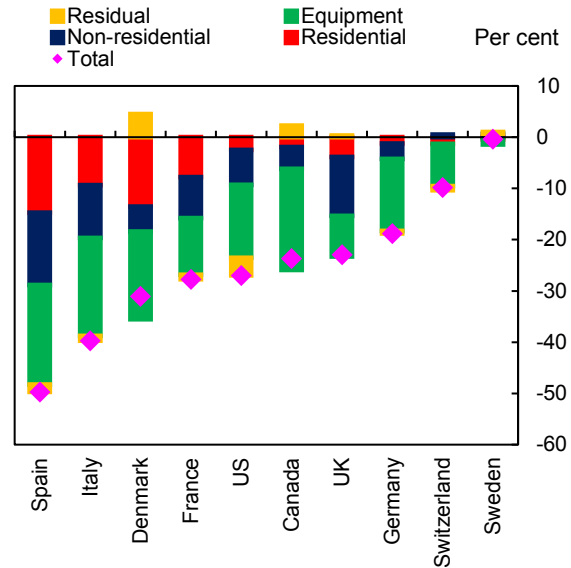
Advanced economy investment has fallen relative to GDP and remains lower than past episodes



Source: IMF World Economic Outlook and Bank calculations.

Chart 4

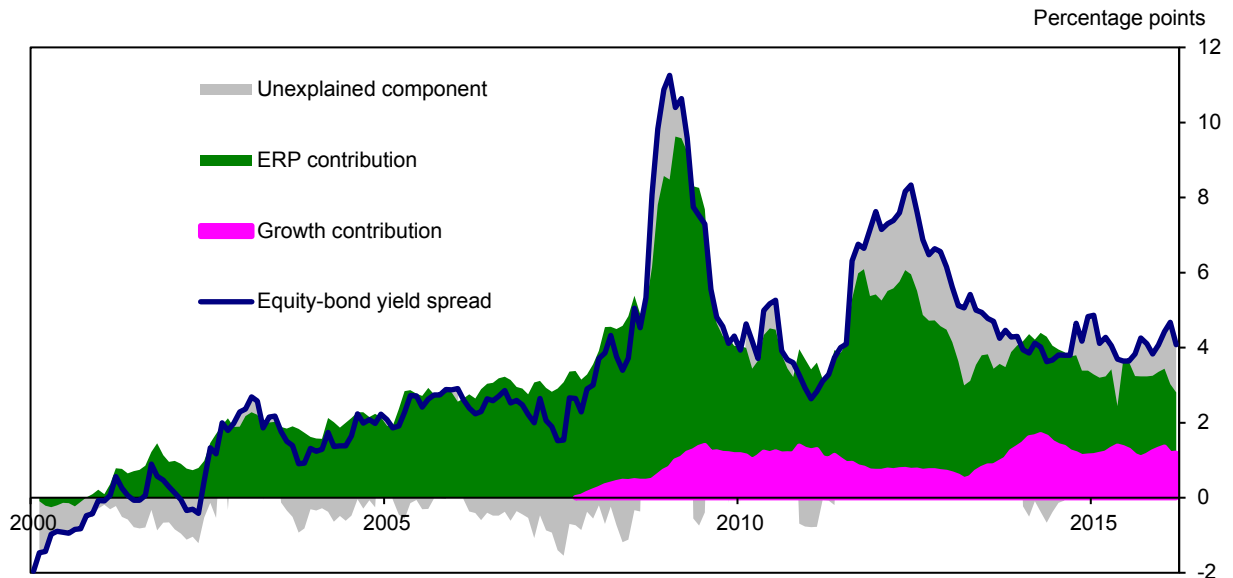
Whole economy real investment substantially weaker than pre-crisis forecasts



Source: IMF World Economic Outlook and Bank calculations.

Chart 5

UK equity risk premium up since 2000, and together with lower growth expectations, explains bulk of the spread between earnings yield on equities and bond yields currently



Source: IMF, Bloomberg, Thomson Reuters Datastream and Bank calculations. The equity-bond yield spread is the difference between the reciprocal of the FTSE All-Share price-earnings ratio and the UK 10-year government bond yield. The growth contribution is calibrated from the IMF 5-year-ahead world growth and inflation forecasts. The ERP contribution is calibrated using the VAR model described in Chin and Polk (2015), 'A forecast evaluation of expected equity return measures', Bank of England Working Paper, No. 520.

The Bank of England has long stressed that central bank policies are not the cause of low rates but responses to them.¹⁰ We are actors in a play written by others.¹¹

That is because the level at which interest rates must ultimately settle to ensure demand consistent with supply and so inflation at target – the “equilibrium” interest rate, or “ r^* ” – is determined, not by central banks, but by the real, fundamental factors driving desired savings and investment in the global economy.

These include technology growth, demographics, the ease of financial intermediation, and inequality. Colleagues at the Bank have estimated that such factors have conspired to lower real interest rates by around 450 basis points since the early 1980s.¹²

Long-run prosperity was never in the gift of monetary policy makers. As the 10th anniversary of the start of the crisis approaches, a consensus is growing that escaping this low-growth low-inflation trap will require a rebalancing between monetary, fiscal and structural policies.

The last are the most important. In addition to their merits in raising potential growth directly, structural reforms could improve the savings and investment balance, thereby increasing equilibrium interest rates (r^*) and giving monetary policy more traction.

Bank staff estimate that shortfalls in public investment represent only a modest portion of the 450 basis points fall in global interest rates since the early 1980s.

Clear policy frameworks that encourage sustained private investment are thus essential, including those that mobilise private investment to finance the transition to the low-carbon economy. As I will discuss, the magnitudes required are significant, the horizons long, and the distribution *Pareto improving*.

Theory suggests capital should flow from advanced to emerging economies – where the returns are highest. For long spells, however, the opposite has happened, confounding the textbooks and further driving down advanced economy bond yields. And on the occasions when capital has flowed to emerging markets, it has been too volatile, amplified cycles, distorted asset prices and fed credit imbalances in recipient countries.

In this context, green finance is a major opportunity. By ensuring that capital flows finance long-term projects in countries where growth is most carbon intensive, financial stability can be promoted. By absorbing excess global saving, equilibrium interest rates can be raised and macroeconomic stability enhanced. And by allocating capital to green technologies, the prospects for an environmentally sustainable recovery in global growth will increase.

Seizing this opportunity requires a comprehensive climate policy framework.

III. Paris brings forward the horizon

With the Paris Agreement, governments have stepped up.

In a display of international coordination of which Arthur Burns would have been proud, world leaders committed to curb carbon emissions and limit the rise in global average temperatures

¹⁰ See Carney (2013), “The spirit of the season”, speech to the Economic Club of New York; Broadbent (2014), “Monetary policy, asset prices and distribution”, speech at the Society of Business Economists Annual Conference; Bank of England *Inflation Report*, February 2014, page 40.

¹¹ See Broadbent (ibid.).

¹² See Rachel, L and Smith, T (2015), “Secular drivers of the global real interest rate”, Bank of England Working Paper No. 571.

relative to those in the pre-industrial world to 2°C, and to pursue efforts to limit the temperature increase to 1.5°C.¹³

Underpinning the Paris Agreement is recognition that the stock of greenhouse gases in the atmosphere should not exceed the remaining carbon budget, which according to the Intergovernmental Panel on Climate Change (IPCC) amounts to 1000 gigatonnes of CO₂ from 2011 onwards.¹⁴

Countries have set their ambitions by submitting their Nationally Determined Contributions (NDCs).¹⁵ At present, these commitments are of varying degrees of specificity, and most still need to be fleshed out to be consistent with the aggregate carbon budget. The Paris Agreement requires that NDCs be updated regularly and that each should be a progression on the last.

Crucially, the Paris Agreement provided an objective assessment that, even if all of the policies implied by the Agreement were implemented, global temperatures would rise by at least 2.7 degrees by 2100.¹⁶ In other words, the world has committed to do something, but not yet enough to meet its stated goals.

Therefore, Paris clarifies actual and stretch objectives. It provides detailed climate policies and creates the prospect of a future ratcheting up of efforts. In doing so, it greatly increases transition risks as well as opportunities. By bringing forward the horizon, it puts a premium on the ability of private markets to adjust.

IV. Building a market in transition to a low-carbon economy

Smooth adjustment is crucial because transition risks are how success could turn into failure. Specifically, sudden changes in policy, technology and physical risks could prompt a reassessment of asset values as costs and opportunities become apparent. In other words, an abrupt resolution of the tragedy of horizons is in itself a financial stability risk.

We have already seen cases where there have been sharp changes in valuations. The combined market capitalisation of the top four US coal producers has fallen by over 99% since the end of 2010, and three have recently filed for bankruptcy (**Chart 6**).¹⁷ There has been similar, albeit less acute, drama for the more diversified German utilities (**Chart 7**).

¹³ See United Nations Framework Convention on Climate Change, “Paris Agreement”, 2015, available at: http://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf.

¹⁴ IPCC Synthesis Report (2014) and Bank calculations, in Batten, S, Sowerbutts, R, and Tanaka, M, “Let’s talk about the weather: the impact of climate change on central banks”, Bank of England Staff Working Paper (2016).

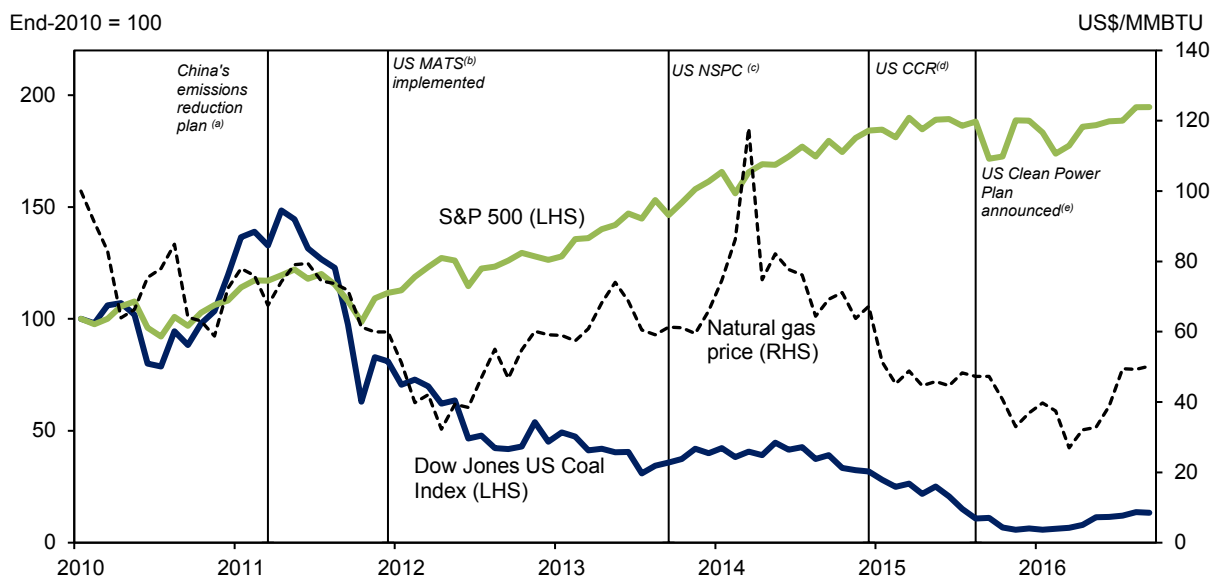
¹⁵ For example, the US will seek to reduce emissions against 2005 levels by 26–28% by 2025; China will seek to reduce against 2005 levels by 40–45% also by 2025 and the European Union will seek to reduce by more than 40% against 1990 levels by 2030.

¹⁶ See United Nations Framework Convention on Climate Change, (2015).

¹⁷ Those filing for bankruptcy were Peabody Energy, Arch Coal and Alpha Natural.

Chart 6

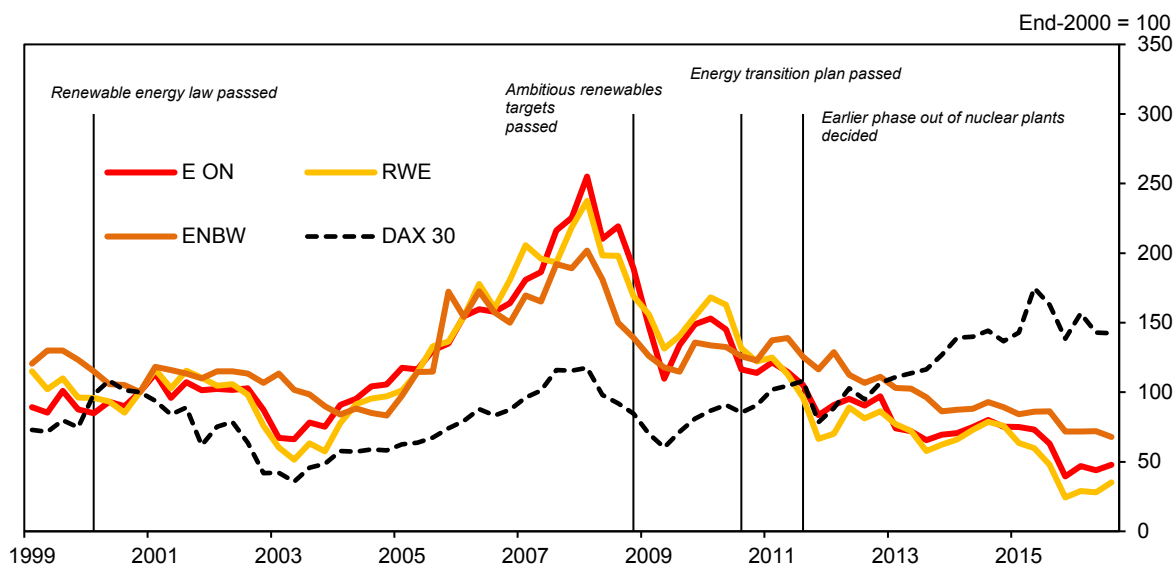
US coal sector index and S&P 500 against regulatory announcements and other demand factors



Source: Thomson Reuters DataStream, Bank calculations. (a) The Chinese government announced emissions reductions targets in March 2011, which may have contributed to slowing of coal consumption, including a marked slowdown in coal imports from the US. (b) Mercury and Air Toxic Standards (MATS) required installation control technology which a large share of coal plants did not have. (c) New Source Performance Standards: raised efficiency requirements for new coal units. (d) The Coal Combustion Residuals (CCR) Rule introduced a set of requirements for the safe disposal of CCRs, commonly known as coal ash, from coal-fired power plants. (e) Proposed to reduce CO₂ emissions by about 30% by 3030.

Chart 7

Share prices of German utilities and DAX 30 index, against key energy sector regulatory announcement



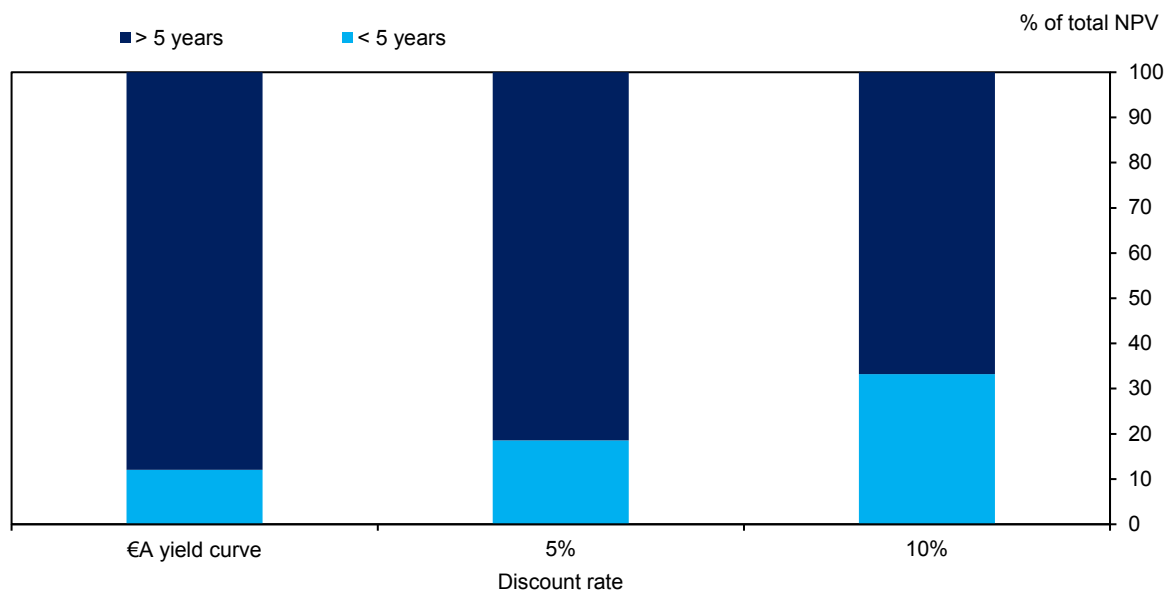
Source: Thomson Reuters DataStream, Bank calculations.

Markets bring the future forward, with financial impacts often occurring immediately, even if the real impact is several years into the future. For example, in today's low rate environment,

around 90% of the value of the average German utility bond derives from cash flows beyond five years (**Chart 8**).

Chart 8

Net present value of a typical German utility bond with 30 year maturity



Source: Bank calculations. A 30-year maturity is representative of bonds recently by German private utilities in 2015 and 2016.

The point is that the more we invest with foresight; the less we will regret in hindsight. Financial stability risks will be minimised if the transition begins early and follows a predictable path, thereby helping the market anticipate the transition to a two-degree world.

And that requires the right information. On this front, there has also been considerable progress in a short period of time.

V. The task force on climate-related financial disclosures (TCFD) and the need for better information

An obstacle to a smooth adjustment has been the absence of information to help market participants make a market in climate-related financial risk. Companies do not know what to report or how to report it. Investors – even well-informed ones – cannot access the information they need to assess the risks in their portfolios.

In late 2015, at the request of G20 Leaders¹⁸, the FSB established an industry-led Task Force, under the leadership of Michael Bloomberg. It is developing recommendations for voluntary, consistent, comparable, reliable and clear disclosures around climate-related financial risks for companies to provide information to lenders, insurers, investors and other stakeholders.

Since a private sector solution is needed to get this right, the Task Force consists of a careful balance of issuers, investors, creditors, rating agencies, accounting firms and climate risk

¹⁸ The G20 had previously asked, in its April 2015 Communique, that the FSB “convene public- and private-sector participants to review how the financial sector can take account of climate-related issues”.

experts. Members are drawn from advanced and emerging economies, including from the German energy and auto sectors.¹⁹

In April, the Task Force published for consultation its Phase I Report, which took stock of the existing landscape of disclosure initiatives and set out the scope and objectives of its work.²⁰ Initial findings confirmed that existing schemes vary in their status (from laws to voluntary guidelines) and in their ambition (breadth and depth of disclosures). Disclosure is currently incomplete and fragmented, with, for example, only around a third of the top 1000 US companies producing broadly comparable information on the financial risks posed by climate change.²¹

Let me offer an outside observer's perspective on three of the core issues which the Task Force touched on in its Phase I Report and must address in its Final Report to be submitted to the G20 early in the German Presidency.

First, static disclosures of current carbon footprints are not sufficient to reveal a company's climate-related financial risks. Investors and creditors need to know the strategic as well as the static.

A mix of forward-looking, and sufficiently granular, qualitative and quantitative information is needed to offer real insight into how climate-related risks and opportunities may impact a firm's existing and future business lines. This could include information on governance and management of such risks, and on a firm's mitigation strategy and its financial planning, including capital expenditures and R&D.

Second, the robustness of a firm's strategy and targets could be further illuminated through scenario analysis. For investors to price financial risks and opportunities correctly, they need to weigh firms' strategies against plausible public policy developments, technological advances, and evolving physical risks.

A full exploration of transition risks may require consideration of financial risks and opportunities under several scenarios. An important question is what form these scenarios should take.

One option for a global firm operating across multiple markets could be to apply a transition scenario that takes into account the NDCs of the countries in which its businesses are located. This could support analysis of whether a company is under- or over-performing relative to articulated policy frameworks. Another very relevant scenario is, of course, the ultimate two-degree goal agreed in Paris.

Firms may develop their own transition scenarios or build on commonly available models. The latter may prove useful to assess against the commitments made in Paris. Either way, the assumptions and methodologies will need to be sufficiently transparent to allow for comparisons and external challenge.

Third, there may be merit in considering a proportionate approach that scales the granularity of disclosures to the risks faced by firms. As a proxy, Calpers estimates that out of the 10,000 firms in their equity portfolio, 314 are responsible for 75% of the emissions.²²

In determining a proportionate approach, I would caution, however, against losing sight of one of the potential benefits of improved disclosures, namely that of helping to make a

¹⁹ A full list of Task Force members can be found at: <https://www.fsb-tcfd.org/about/#>.

²⁰ See "Phase I Report of the Task Force on Climate-related Financial Disclosures", (March 2016), available at: https://www.fsb-tcfd.org/wp-content/uploads/2016/03/Phase_I_Report_v15.pdf.

²¹ As described in Ceres (2014), "Gaining Ground – Corporate Progress on the Ceres Roadmap for Sustainability".

²² Forthcoming at: <https://www.calpers.ca.gov>.

market. This requires that investors have the information they need to seek out prospective risks and rewards across all sectors, from agriculture to car manufacturing to consumer goods.

I am pleased to report that the Task Force is getting to grips with these thorny issues and is on track to report to the FSB later this year and to submit its Final Report to the German G20 Presidency in early 2017.

VI. Mainstreaming green finance

Financing the de-carbonisation of our economies implies a sweeping reallocation of resources and a technological revolution.

The International Energy Agency estimates that globally as much as €45 trillion of investment in total could be needed in power supply and end-use efficiency to meet the two-degree target agreed in Paris.²³ China alone is likely to require around €500 billion a year from 2016 to 2020 to finance its national environmental goals.²⁴ A substantial proportion of this is likely to be raised off shore, absorbing excess global savings, helping to push up global equilibrium interest rates, and ultimately increasing global growth.

With investment in long-term infrastructure assets needing to quadruple, green investment represents a major opportunity for both long-term investors and macroeconomic policymakers seeking to jump-start growth. For this to happen, however, green finance cannot conceivably remain a niche interest over the medium term.

That's why, at the request of G20 Leaders, authorities are exploring ways to mobilise private capital for green investments. During 2016, under China's G20 Presidency, a Green Finance Study Group (GFSG)²⁵, undertook a stocktake of institutional and market barriers to green finance and identified ways to mobilise private capital for green investment.

One proposal is international collaboration to facilitate cross-border investment in green bonds.

The development of this new global asset class is an opportunity to advance a low carbon future while raising global investment and spurring growth.

For investors, green bond markets offer a stable, rated and liquid investment with long duration. For issuers, green bonds are a way to tap the huge US\$100 trillion pool of patient private capital managed by global institutional fixed-income investors. The shift to the capital markets from banks will also free up limited bank balance sheet capacity for early-stage project financing and other important infrastructure lending.

The green bond market is gradually gathering speed. Annual issuance rose from just US\$3 billion in 2012 to US\$42 billion in 2015.²⁶ It could double this year with issuers ranging from US regional authorities raising funds domestically to invest in water projects, to Chinese and Indian corporates, issuing in a range of currencies, in major financial centres, including London, to finance renewable energy projects.²⁷

²³ This figure consists of (i) investment that will be needed to stay in line with current policy commitments and (ii) additional investment needed to achieve a least-cost two degree outcome. See: International Energy Agency, World Energy Outlook 2015.

²⁴ See "Green Finance – A Growing Imperative", Paulson Institute, SIFMA, Green Finance Committee, UNEP Inquiry, 2016.

²⁵ The GFSG was jointly chaired by the Bank of England and People's Bank of China, with the United Nations Environment Programme providing the secretariat.

²⁶ See Climate Bonds Initiative, "2015 Green Bond Market Round-up".

²⁷ For a list of green bonds issued see: <https://www.climatebonds.net/cbi/pub/data/bonds>.

Despite this progress, total issuance still accounts for less than 1% of holdings by global institutional investors.

To reach escape velocity, market participants and public authorities will need to coordinate to deliver common green bond frameworks and definitions, and other necessary supporting infrastructure, to build local and cross-border markets.

Specific measures could include:

- Developing a “term sheet” of internationally recognised standardised terms and conditions for a green bond.
- Creating voluntary definitional frameworks, certification and validation to give certainty to issuers and investors that the project being financed is “green”.
- Integrating environmental risk and green certification into credit ratings.
- Developing green bond indices to unlock the potential investment power of passively managed investments.
- Assessing the scope for standardisation and harmonisation of principles for green bond listings to promote efficient trading and adequate liquidity.

Authorities are now working with the private sector to develop a green bond term sheet with standardised terms and conditions.²⁸ This should significantly improve the ease and efficiency of green bond issuance and simplify investor access to green bond markets in multiple currencies, thereby moving them into the mainstream of finance.

VI. Conclusion: markets that value the future

Financial policymakers will not drive the transition to a low-carbon economy. Governments will establish the frameworks, and the private sector will make the investments.

Nonetheless, financial policymakers do have a clear interest in ensuring the financial system is resilient to any transition hastened by those decisions. Our role is to help develop the frameworks for markets to adjust efficiently.

Given the uncertainties around climate, not everyone will agree on the timing or scale of adjustment required. The right information allows sceptics and evangelists alike to back their convictions with their capital.

A market in the transition to a two-degree world can be built. 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”.

And it would allow feedback between the market and policymaking, making climate policy a bit more like monetary policy, with policymakers learning from markets’ reactions, and markets internalising policymakers’ objectives, strategies and instruments.

When rates are low, the present value of future returns and risks are greater.

²⁸ Specific issues being addressed include: (i) ensuring use of proceeds is clearly delineated for a green project or activity; (ii) issuers having a clearly defined process to validate proceeds are being used for intended, and stated purpose; (iii) a clear, transparent and regular mechanism for reporting the use of proceeds, often involving second or third-party verification; and (iv) finally an appropriate dispute mechanism for when these other conditions are not met.

That is why a vocal minority are already calling on businesses to invest for the future, including by supporting the transition to a low carbon economy, and for investors to internalise the risks and opportunities of climate change²⁹

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, and building a mainstream green bond market, we can help resolve the Tragedy of the Horizon.

The G20 – whose members account for around 85% of global emissions – has a unique responsibility. The German Presidency could be decisive.

²⁹ For example, Blackrock, the world's largest asset manager, has called on businesses to lengthen their horizons, and for all investors to take the risks and opportunities of climate change into account. Larry Fink, Chief Executive at Blackrock, sent a letter to chief executives at S&P 500 and large European corporations in February 2016. See also Blackrock, "Adapting portfolios to climate change", (September 2016).