Climate Policy is Macro Policy

2022 Volcker Lecture at NABE Conference

Mark Carney[1]

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I. Introduction

It is a great honour to deliver the 2022 Paul Volcker lecture.

Paul's accomplishments and the lessons he bestowed are legion. He is best remembered for his success as Chair of the Federal Reserve in eradicating the high and volatile inflation that plagued America in the 1970s and early 1980s. From that singular achievement, we learned the value of operational independence of monetary policy and the importance of credible and forceful actions to quell high inflation and anchor inflation expectations.

Many of Paul Volcker's other contributions sprang from his deep understanding of the interdependencies within the economic and financial systems. Throughout his career, he was a tireless advocate of improving international cooperation to promote monetary and financial stability. From his time at the helm of US Treasury and the Federal Reserve Board, Volcker understood how the relationship between monetary and fiscal policies could be virtuous or vicious. From his spells at the NY Fed and in private finance, he knew first-hand how financial markets could anticipate and reinforce credible policies.

Paul understood that financial markets need consistent, comparable, and decision-useful disclosure to do their job. That's why he became the inaugural Chair of IFRS Foundation Trustees and shepherded in the first uniform global accounting standard.

And finally, Paul Volcker foresaw the enormous threats from climate change. Never one to avoid tough choices, he was an early and vocal advocate of a carbon tax.[2]

[1] I am grateful Regana Alicka, Zineb Bouzoubaa, Di Chen, Ronan Hodge, Maia Johnson, Simone Kramer, and Jen Nemeth for help in the preparation of this lecture, which also benefitted enormously from earlier conversations about the core ideas with Nabeel Abdoula, Jean Boivin, Gavyn Davies, Adam Posen and Jan Vlieghe, as well as from the debate and scrutiny at Secular Forum of the PIMCO Global Advisory Board. All errors and omissions remain my responsibility.

[2] Financial Times, 'Four former Fed chairs call for US carbon tax' https://www.ft.com/content/e9fd0472-19de-11e9-9e64-d150b3105d21

Today, I will draw on this legacy to consider the macro-economic challenges of the next decades. Economic history is rhyming with alarming force and frequency. The economic environment is now very different from that which reigned since the global financial crisis. Deficient demand and divine coincidence are out, trade-off inducing supply shocks and malign coincidence are in.

I will argue that the policy responses to these developments cannot be considered in isolation of climate change. Indeed, whether it is addressed or ignored, climate change is now macro critical, and climate policy has become the third pillar of macro policy. The conduct of climate policy will directly impact the efficacy of fiscal and monetary policies, and its interactions with the financial system will heavily influence the pace of job and wealth creation. Like the rate of inflation, the degree of climate change is a choice, one that affects the prosperity and welfare of all. On climate change, as with the Volcker disinflation, now is not the time for half measures.

II. Climate Change is Macro Critical

Our planet's average temperature is already 1.1° Celsius warmer than pre-industrial levels (**Charts 1,2**), and the last seven years have been the warmest on record.[3] The impacts on our planet's finely tuned ecosystems are escalating. Our oceans are becoming much more acidic, sea levels are rising (**Chart 3**), and the pace of polar ice loss is accelerating (**Chart 4**). Extreme climatic events—hurricanes, wildfires and flash flooding—are multiplying.

These changes are not only eliminating individual species but also destroying entire habitats such that the population of mammals, birds and reptiles has fallen 70% since I was born. What had been biblical is now commonplace.

Perhaps because they were not financially valued, these losses in nature were downplayed, and their cause treated as an issue for another day. But now the effects of climate change are beginning to affect assets which have market prices, making the scale of the calamity more tangible.

[3] World Meteorological Organisation (2022) https://public.wmo.int/en/media/press-release/2021-one-of-seven-warmest-years-record-wmo-consolidated-data-shows

I know from my time supervising the world's fourth largest insurance industry that since the 1980s, the number of extreme weather events has tripled causing an eight-fold increase in insured property destruction.[4] An even greater value of assets is uninsured, with the global protection gap reaching a record $104bn in 2020.[5] These losses are expected to rise sharply, with coastal flooding is projected to increase by 50 per cent by the end of this century, threatening assets worth one quarter of global GDP.[6] In parallel, the livelihoods and lives of over a billion people will be directly affected by the spread of lethal climatic conditions.

Insured losses measure the value destruction of the stock of assets. GDP is a measure of the flow of income. Estimates suggest that, over the balance of this century, climate change could cause the equivalent of a decade of no economic growth (**Chart 5**). Of course, GDP represents a single year's worth of value added in the economy. In general, estimates of the impact of climate change project that what is lost is likely to stay lost, making climate change the curse that keeps on taking.

As significant as these figures are, it is instructive to think of what is not included in them, both those assets outside the market economy—such as biodiversity and human health—and those economic channels not modelled including disrupted supply chains, and the very real challenges to monetary and financial stability that climate change will present.

Lest this quick summary appear too gloomy, let me balance it with the macroeconomic upside from addressing climate change. In particular, the net-zero transition represents a multi-decade investment boom after a decades-long drought. Although estimates vary depending on whether they focus on the energy transition, broader industrial restructuring, or the full range of investments to adapt our infrastructure and build resilience for a warmer and more volatile climate, even in the most limited cases, they are enormous (**Chart 6**).

For example, the IEA (2021) calculates that to be on track for 1.5 degrees warming, global investment in energy infrastructure alone must rise from 2.5 percent of world GDP in 2016–20 to 4.5 percent by 2030, before gradually returning to 2.5 percent by 2050[7]. Arguably in a

[4] Swiss Re Institute (2021) https://www.swissre.com/media/news-releases/nr-20211214-sigma-full-year-2021-preliminary-natcat-loss-estimates.html
[5] Swiss Re (2020) https://www.swissre.com/media/news-releases/nr-20201215-sigma-full-year-2020-preliminary-natcat-loss-estimates.html
[6] Kirezci et al. Projections of global-scale extreme sea levels and resulting episodic coastal flooding over the 21st Century (2020),.
[7] IEA (2021) Net Zero by 2050 https://www.iea.org/reports/net-zero-by-2050

more fragmented energy market where security concerns have become paramount, the figures will be even higher.

The product of this investment is a secure and sustainable energy system, carbon-competitive economies, more jobs and higher growth. With respect to the last, the IEA forecasts material GDP multipliers, with global output that is more than 4% higher by the end of this decade (**Chart 7**).

Investment on this scale would completely offset the investment shortfall (the twin of the savings glut) that has emerged this millennium (**Chart 8**).[8]

All else equal, this would increase the equilibrium real interest rate, r*, thereby reducing the risks of monetary policy being trapped at the effective lower bound and raising both the path and terminal values of monetary policy rates consistent with price stability (**Chart 9**).

Which brings me to the inflationary impact of climate change**,** starting with the impact of a transition to a net zero economy consistent with limiting temperature rises to 1.5 degrees.

While fundamentally positive and likely to be less inflationary than keeping with current insufficient climate policies, the net zero transition can be expected to put upward pressure on inflation during the initial decade of the transition, until the lower levelized costs of clean energy weigh on prices thereafter.

While there are some lesser effects, such as increases in the prices of key commodities, the most important inflationary impact of the transition is that it constitutes a major supply shock that affects virtually every sector of the economy in every region. As Jean Pisani-Ferry points out, on a simple comparison it is on the same order of magnitude as the oil shocks of the 1970s which rendered large swathes of the economy uncompetitive and triggered the inflationary spiral that Paul Volcker eventually had to vanquish. [9]

[8] As Jean Pisani Ferry (2021) calculates, an increase of 2 percentage points (if at global level) would more than reverse the decline in the world investment ratio from 25.7 % in 1980–89 to 24.3 % in 2010–19. Jean Pisani Ferry. August 2021. 'Climate Policy is Macro-Economic Policy, and the Implications will be Significant.' Peterson Institute for International Economics Policy Brief.

[9] Jean Pisani Ferry. August 2021. 'Climate Policy is Macro-Economic Policy, and the Implications will be Significant.' Peterson Institute for International Economics Policy Brief. Roughly 36 gigatons of global carbon emissions (2019) would amount to 4.1 percentage points, or 3.7 percentage points above what he estimates as the current average carbon price of $10. In comparison, the 1974 oil shock resulted in the repricing of 19.7 billion barrels of oil from $3.3 to $11.6/barrel; the corresponding shock amounted to 3.6 percentage points of the 1973 global GDP.

Of course, unlike the oil shock, the price impact of the net zero transition will be spread over years rather than concentrated in a few months. Analysis by Jean Boivin et al. (2022) straight lines this increase over the next decade implying a notable 40 basis points impact on annual inflation.[10]

A more comprehensive assessment of price dynamics in the NGFS Net Zero scenario uses a higher shadow global carbon price path running from $175 by 2030 to $300 by 2040**.** These shadow carbon prices are equivalent to 4% of GDP at peak over the next decade before gradually declining to 2 ppts by 2040s (as there is less carbon that is emitted).[11]

In the NGFS modelling, central banks pursue flexible inflation targeting consistent with a backwards-looking Taylor Rule. As **Chart 10** shows, the annual inflation impacts are large ranging between 100-200 basis points in the US in the first half decade, before fading and becoming deflationary as the greater cost competitiveness of clean energy takes hold. The impacts in the less-energy intensive Euro Area are smaller but still macro significant (**Chart 11**).

In both models, policy rates do not match the increase in inflation given the trade-off (i.e. real rates fall). Crucially, inflation expectations are assumed to remain well anchored as monetary policymakers draw on a seemingly infinite reservoir of credibility. Paul Volcker's legacy is large, but central bankers should remember that even the most generous bequests can be exhausted. This is especially true since the net-zero transition will be only one of several supply shocks our economies face in coming years.

III. A World of Supply Shocks

The global economy is undergoing a series of major transitions with significant implications for macroeconomic policy and asset prices. The long era of low inflation, suppressed volatility, and easy financial conditions is ending. It is being replaced by more challenging macro dynamics in which supply shocks are as important as demand shocks, increasing inflation, volatility, interest rates and risk premia.

[10] Bartsch, Boivin & Brazier. January 2022. 'A World Shaped by Supply', Blackrock Investment Institute. https://www.blackrock.com/corporate/literature/whitepaper/bii-macro-perspectives-january-2022.pdf
[11] See NGFS https://www.ngfs.net/en/publications/ngfs-climate-scenarios

Covid may prove the last battle of the last war. With the first severe lockdowns, the economic impact fell primarily on demand. Central banks, concerned about the liquidity trap and risks to financial stability, not only massively eased policy but also shifted their reaction functions by committing to sustained overshoots of inflation. This was a tactic—a new tool—in the face of very low r* and a perceived deflationary shock. Considerations regarding the degree of inflation overshooting are now ones of strategy.

In the near term, Covid is moving from pandemic to endemic at different rates in different regions. This will continue to challenge global supply chains given their heavy reliance on Asia. Russia's horrific invasion of Ukraine is the second massive negative supply shock in two years. The war has accelerated the forces of de-globalisation. Continuing a trend, sanctions have targeted technology and finance. Geo-political risks have ruptured European energy markets. More broadly, companies are building more resilient supply chains and are increasingly engaged in geo-strategic onshoring. The resulting fragmentations of the global system will increase domestic security, while raising costs and increasing economic volatility.

Just as globalisation was deflationary (**Chart 12**), its unwinding will be inflationary.[12]

This is a new environment for monetary policy.[13]

Shocks to aggregate demand drive inflation and output in the same direction. These can include variations in government consumption, households' desire to consume, or business' desire to invest. Because monetary policy influences demand it can lean against such shocks and stabilise inflation. In this case, no output-inflation trade-off arises under so-called "divine coincidence" (**Chart 13**).

That was the case prior to the global financial crisis for all major economies and for the period between the global financial crisis and Covid for the US and EU (**Charts 14, 15**).

Things are different when shocks drive inflation up or down independently of demand. Exogenous changes in firms' pricing power are one example – so-called cost-push shocks.

[12] Mark Carney. 2017. *Globalisation and Inflation.* IMF Lecture in Honour of Michel Camdessus. https://www.bankofengland.co.uk/-/media/boe/files/speech/2017/de-globalisation-and-inflation.pdf?la=en&hash=E0C5E30A659BB8F9564F3FA0B3F5C1C1A10F199F
[13] Mark Carney. 2017. 'Lambda'. Speech at LSE. https://www.bankofengland.co.uk/-/media/boe/files/speech/2017/lambda.pdf?la=en&hash=024E1D5DA7CA7BBD19360E75227E69D805E499CA

Shocks to the exchange rate, commodity prices or the economy's supply capacity also have similar characteristics. Because monetary policy's influence on inflation is predominantly indirect, via demand, in such circumstances inflation can only be controlled by causing a reduction in spending via higher interest rates.

Since the global financial crisis, major central banks, particularly in the US, EU, and Japan, have generally faced 'divine coincidence' in which low inflation and persistent underemployment both demanded highly accommodative monetary policy. This pushed term premia negative, lowered long-term interest rates, and suppressed volatility across asset classes.

The UK was not as fortunate, facing a series of financial, exchange rate and trade shocks, which necessitated striking trade-offs (**Chart 16, 17**).

Now all major central banks are facing a series of negative supply shocks. The textbook response is to accommodate it through above-target inflation for a period (see Guerrieri)[14] in order to facilitate the reallocation of resources across sectors. Doing so allows prices to rise in sectors that benefit from greater demand relative to prices in sectors losing out. This helps economies to adjust and ultimately means supply constraints are less persistent.[15]

However, pursuing this strategy without losing credibility will be difficult in the face of persistent supply shocks, especially given the less-than-ideal starting point for inflation. The time for tough choices and policy coordination is at hand. Paul Volcker's legacy lives on.

IV. Climate Policy is the New Pillar of Macro Policy

Volcker understood the importance of policy coordination, and that, in inflationary environments, fiscal discipline should complement monetary tightening. This will be challenging over the medium term as governments pay a series of insurance premiums to build more resilient economies including support for the onshoring of technologies and supply chains, and in some jurisdictions spending much more on defence and health care.

[14] Guerrieri et al 'Monetary Policy in Times of Structural Reallocation' https://www.kansascityfed.org/documents/8322/JH_Guerrieri.pdf
[15] Note: The corollary is that, in the face of a positive supply shock, the central bank should accommodate some 'good disinflation/deflation' for better inter-temporal substitution…a point missed by Greenspan et al. during the productivity boom, with consequences for financial bubbles and instability.

Fiscal support will also be required to help workers re-skill during this series of supply shocks. Given these many demands, fiscal capacity for climate action must be targeted and complemented by clear frameworks that drive private investments and innovation.

This leads to the other vector of policy coordination—climate policy—which is now the third pillar of macro policy. The net-zero transition is disruptive, but this should be a controlled disruption—a transition that is guided by credible and predictable policies so that the private sector can drive the necessary investments.

This begins with clear objectives. The foundations for such clarity were laid at COP26 last November, where the proportion global emissions covered by country net zero targets rose from less than one third two years ago to almost 90%.[16] Net zero is now the organising principle for over 5000 of the world's largest companies, and with the right policies, it will become the norm throughout our economies.

Committing to net zero is, of course, just the start, and there is currently a large gap between ambition and action (**Chart 18**).

Governments need to set the terms of, and incentivise, private investment in the net zero transition. As Secretary Yellen and I have emphasised, the more credible and predictable are government climate policies, the more investors will pour in money in anticipation, creating a virtuous circle of large-scale investment, faster decarbonisation, more jobs, and faster growth.[17]

Credible climate policy relies on:

- Broad political support. The experience with inflation targeting demonstrates the importance of politicians across the political spectrum acknowledging the problem and setting clear goals.

[16] Net Zero Tracker https://zerotracker.net/
[17] G30 Report: Mainstreaming the transition to a net zero economy (2020). https://group30.org/images/uploads/publications/G30_Mainstreaming_the_Transition_to_a_Net-Zero_Economy.pdf

- Clear tacking of progress including 'marking to emissions' the carbon budget and clearly identifying gaps in climate policies. A model is independent bodies that assess progress, such as the UK's Climate Change Committee.

- Building a track record of measures to achieve these intermediate goals. Examples includes policies such as the UK and European moratoria on internal combustion engine vehicles from the 2030s and the Canadian legislated carbon price of C$100/tonne in 2030. These future commitments to price the externality of carbon are far enough in the future that companies can act and close enough that they must.

The policy frameworks with the greatest impact will be time consistent (not arbitrarily changed); transparent (with clear targets, pricing, and costing); and committed (through treaties, nationally determined contributions, and domestic legislation).

As Paul Volcker's legacy demonstrates, policy credibility can do much of the work, lowering the tightening required. If climate policy actions are anticipated, they can be more modest, bringing forward investment, smoothing the transition and lowering the inflationary impacts (**Chart 19**). This is Volcker-esque policy coordination that delivers better macro-economic outcomes:

- More investment today with higher GDP and job creation,

- Lower inflation because adjustment and price effects are smoother, and

- Lower emissions and greater energy security.

The ability to create this virtuous circle has been greatly enhanced by the recent progress in creating a financial system ready to finance the net zero transition. To this end, COP26 in Glasgow delivered 24 major reforms that are helping transform the information, tools, and markets at the heart of finance.

Channelling Paul Volcker, this includes measures to ensure financial markets have clear, comparable, and decision-useful climate disclosure so they can manage risks and seize opportunities associated with the climate transition. The IFRS Foundation's new

International Sustainability Standards Board, the ISSB, will produce a climate disclosure standard based on the TCFD and drawing on other frameworks. This will ensure investors in over 130 countries have access to the data they need.

In this vein, I welcome the SEC's consultation on a new US climate disclosure standard[18], which is firmly grounded in the demands of an overwhelming number of investors. Drawing on the private sector led TCFD, the Commission's proposal contains several innovations including requirements to disclose any internal carbon prices, targets and transition plans that companies may have as well as the line-item impacts of physical and transition climate events on consolidated financial statements. Appropriately, material information is to be disclosed in regular company filings, not tucked away in ESG reports.

Investor demand for climate disclosure reflects the growing realisation that addressing climate change is one of the greatest commercial opportunities of our time. Finance on the scale required is now in prospect. As part of the Glasgow Financial Alliance for Net Zero, over 450 major financial institutions from 45 countries are committing to manage their balance sheets totalling over $130 trillion in line with a 1.5-degree net zero transition.[19] That's 40% of all global financial assets.

To be clear, the net-zero transition doesn't mean flipping a green switch or investing only in companies that are already green. Transition means transition. Financial institutions must go to where the emissions are and back companies—including in heavy emitting sectors like steel, cement, and transportation—that have credible plans to transform their businesses for a net zero world. They will also finance traditional energy projects consistent with the climate transition, including helping to phase out stranded assets transparently and responsibly through clear frameworks.

There is increasing evidence that this dynamic is affecting company valuations, starting the virtuous cycle that credible climate policies can reinforce. In particular, lower emitting firms

[18] SEC Proposes Rules to Enhance and Standardize Climate-Related Disclosures for Investors (March 21, 2022) https://www.sec.gov/news/press-release/2022-46
[19] Glasgow Financial Alliance for Net Zero www.gfanzero.com

trade at increasing premiums across sectors,[20] [21] and there are high correlations of the degree of net-zero alignment and valuations (**Chart 20**).[22]

Of course, finance cannot do the job on its own. Finance is an enabler, a catalyst that will speed the transition, but catalysts still need the underlying components, which in this case are the climate policies of countries.

Today's energy crisis reinforces this imperative. In my judgment, the combination of geo-political considerations, the *time scales* required to make meaningful changes to energy mixes, the risks of stranded carbon, and long-term competitiveness should lead to an acceleration of the clean-energy transition. Clean energy is sustainable, competitive, and secure.

For this to become a reality, it is imperative that governments clearly define their energy objectives and allow markets to drive the solutions.

V. Conclusion

Although the monetary tightening of the Volcker Fed is firmly in the central banking pantheon, the very human cost of that disinflation should not be forgotten. A brutal recession and millions of unemployed, a 'sacrifice ratio' necessitated by the string of errors and timid actions that preceded it.

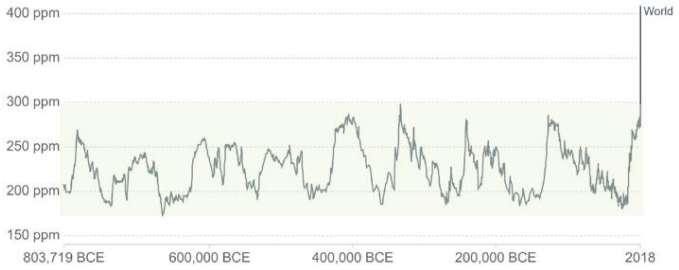
High and volatile inflation at least can be vanquished. It need not be a permanent condition. The same cannot be said of climate change. The world is on course to exhaust our entire carbon budget for a 1.5-degree world this decade. Caught in the climate version of Paul Krugman's *Timidity Trap*[23], we are dithering towards climate disaster—a drift that, if allowed to continue, will at best set up a future climate Minsky moment, with policies that cause abrupt and wrenching economic adjustments, strand trillions of dollars in assets, and impair financial, price and potentially geo-political stability.

[20] Goldman Sachs 'The Dual Action of Capital Markets Transforms the Net Zero Cost Curve' January 2021. https://publishing.gs.com/content/research/en/reports/2021/11/10/5c51f310-fb85-4c59-8fc4-cd33fda537e0.html
[21] https://www.esgforinvestors.com/#
[22] Goldman Sachs 'Taking the Temperature of European Corporates' November 2021. https://publishing.gs.com/content/research/en/reports/2021/10/27/7f75c241-c327-48c3-a6e1-af524e4c1d61.html
[23] Krugman, Paul. 'The Timidity Trap.' New York Times. 20 March 2014. https://www.nytimes.com/2014/03/21/opinion/krugman-the-timidity-trap.html

There is still time to recognise that climate change is macro critical, that climate policy has become the third pillar of macro policy, and that through credible policy coordination we can catalyse enormous private investment that creates jobs, accelerates growth, smooths inflation, and promotes energy security.

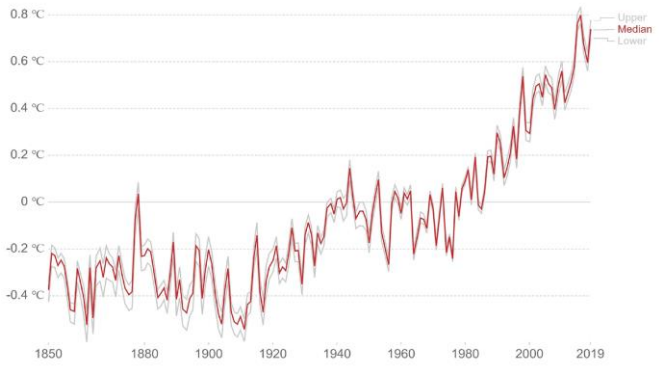
The degree of climate change is a choice, but the window for making that choice is closing rapidly. Paul Volcker wouldn't wait.

Chart 1: Global Atmospheric CO^2 Concentrations



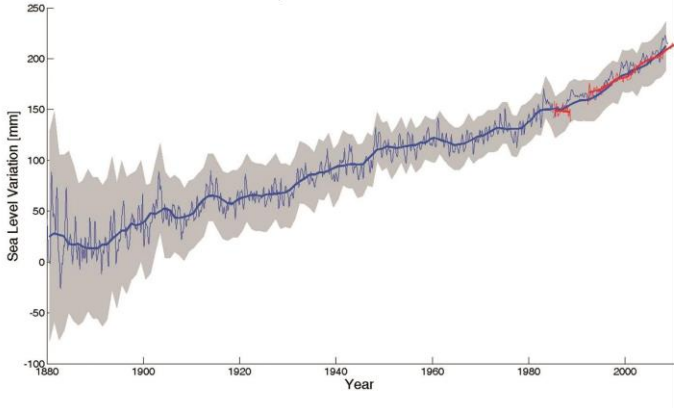
Source: US National Oceanic and Atmospheric Administration (US NOAA) (2018).

Chart 2: Global Temperature variation



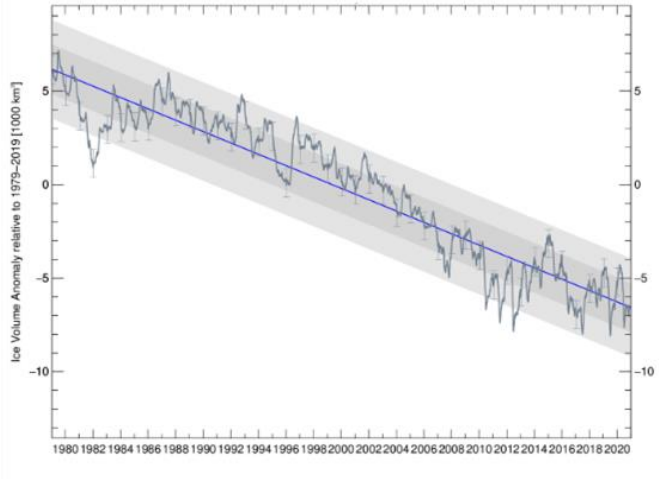
Source: World Meteorological Organization

Chart 3: Sea level variation



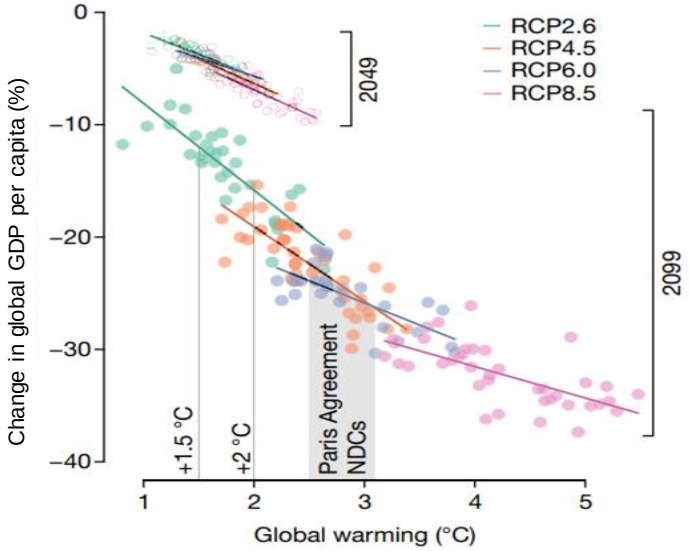
Source: CSIRO

Chart 4: Polar ice loss



Source: National Snow and Ice Data Center

Chart 5: Estimated impact of global warming on global GDP per capita



Source: Burke et al (2018) Large potential reduction in economic damages under UN mitigation targets

Under different RCP forcing scenarios, relative to a no-warming baseline (SSP1). The three vertical black lines denote the 1.5°C target, the 2°C target and the median-estimated warming expected under current Paris commitments (2.9°C).

Chart 6: Selected estimates of the annual investment needed for the net-zero transition

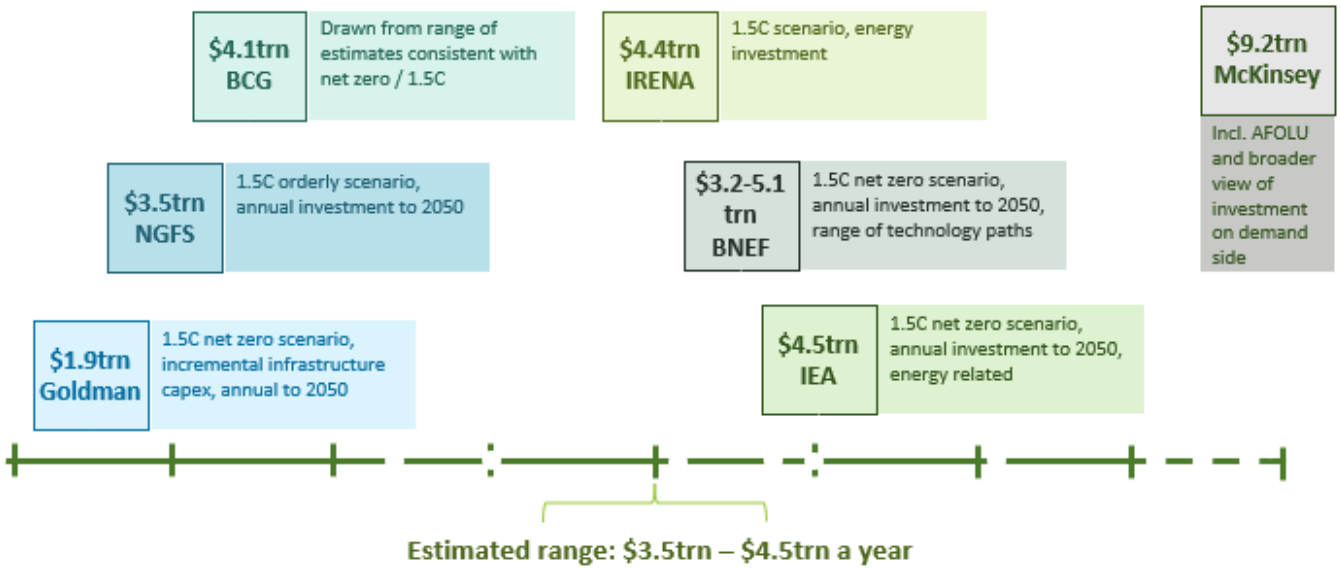
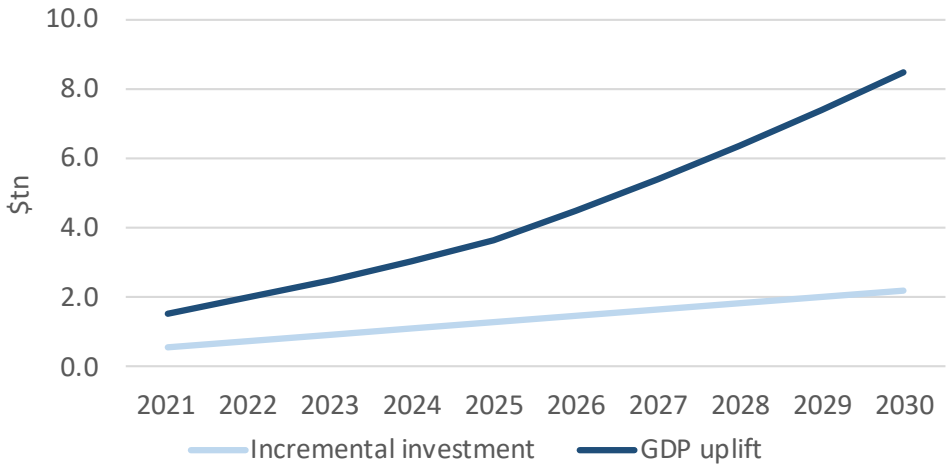


Chart 7: Global GDP uplift from incremental investment in the net-zero transition



Source: GFANZ calculations based on IEA, IMF analysis

Chart 8: *Structural changes have lowered r

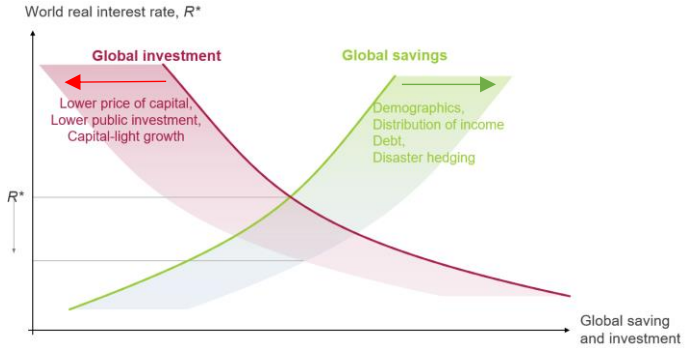


Chart 9: *Transition investment reverses 'investment drought,' raises r

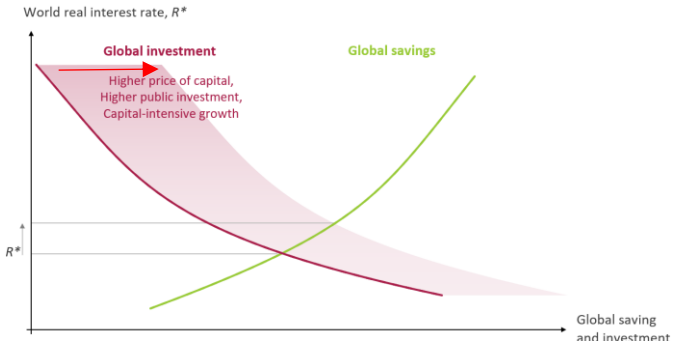


Chart 10: Incremental inflation in net-zero scenario (United States)

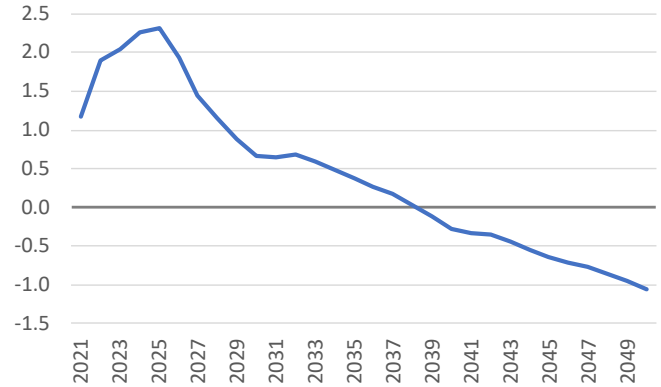
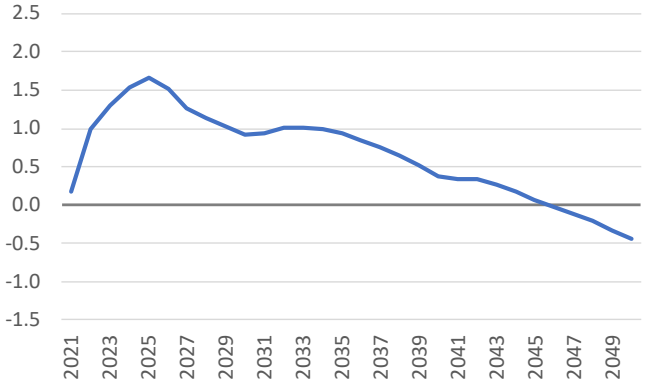


Chart 11: Incremental inflation in net-zero scenario (Europe)



Source: NGFS Scenario Explorer using Net Zero 2050 (with REMIND-MAgPIE 2.1-4.2 inputs)

Chart 12: Effects of globalisation on the Phillips curve

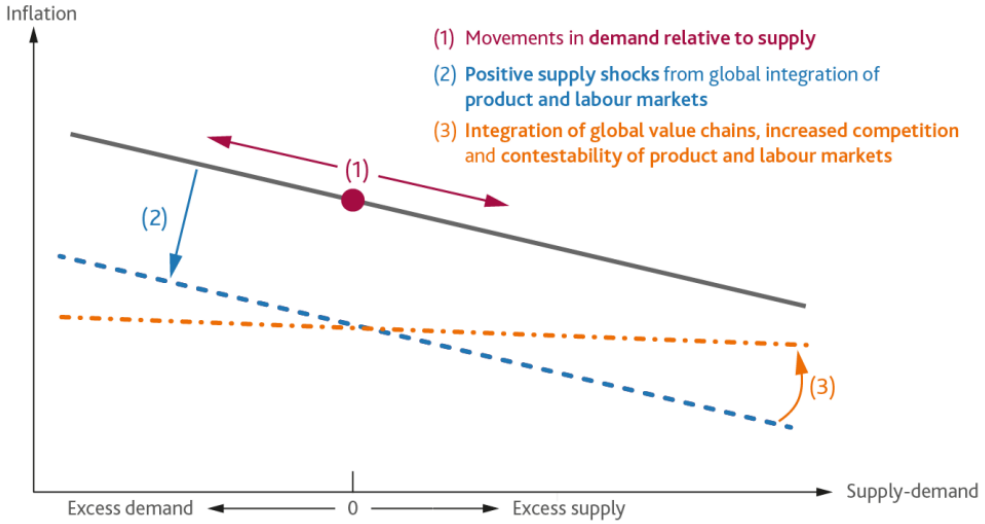


Chart 13: Stylized depiction of the monetary policy trade-off

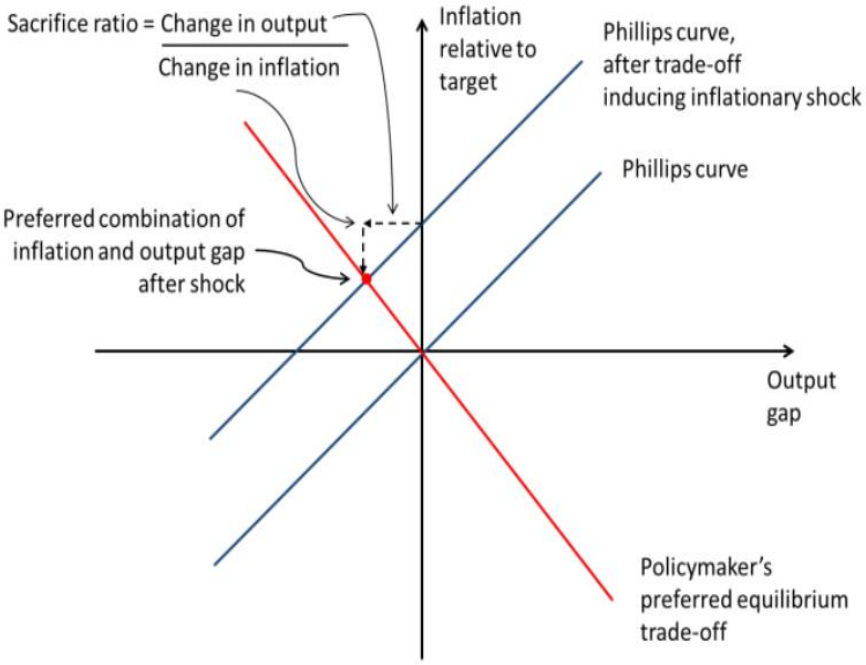
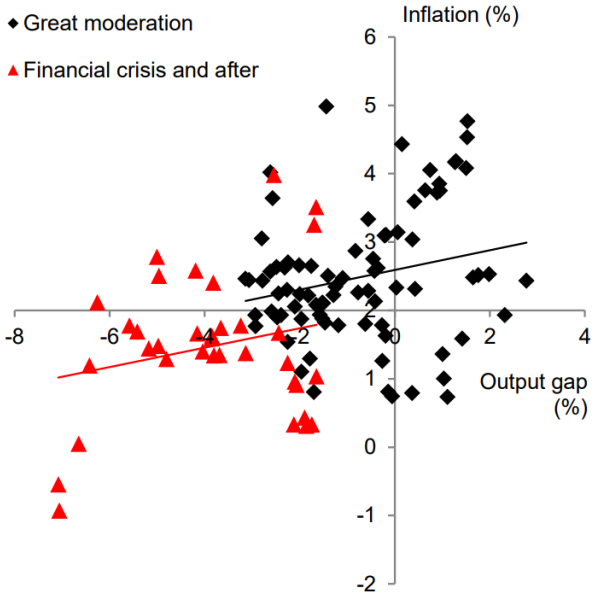
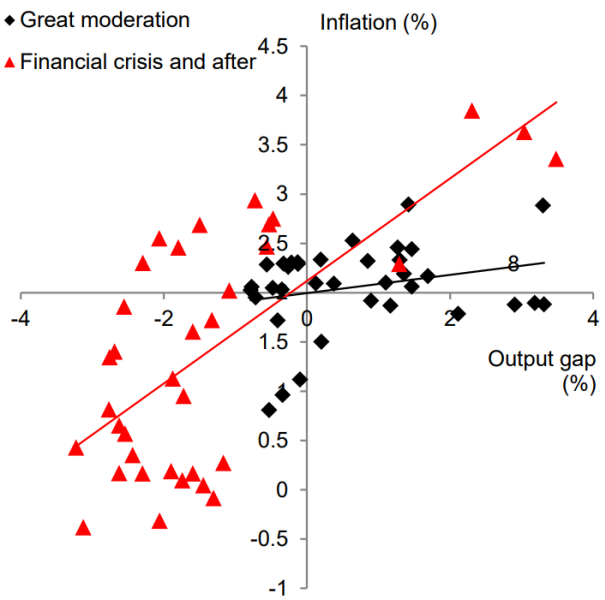


Chart 14: Inflation and Output Gap (United States)



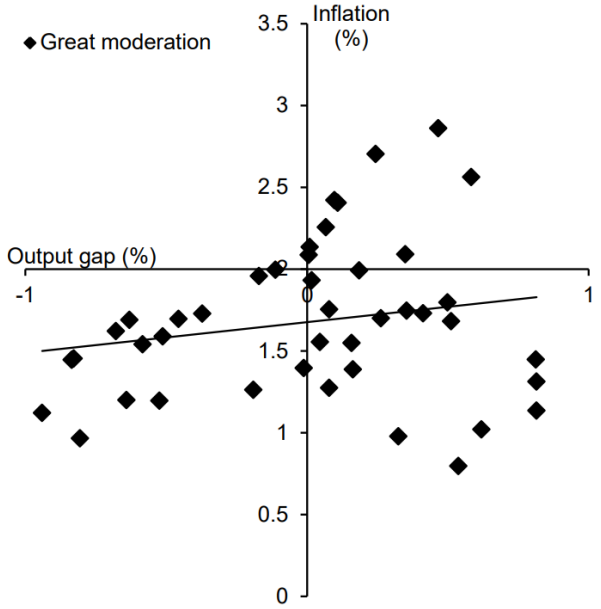
Source: Bureau of Economic Analysis, CBO and Bank of England calculations. The measure of inflation is the four-quarter change in the personal consumption expenditures (PCE) deflator. The output gap is calculated using the CBO estimate of potential output from its August 2016 Update to the Budget and Economic Outlook

Chart 15: Inflation and Output Gap (Euro Area)



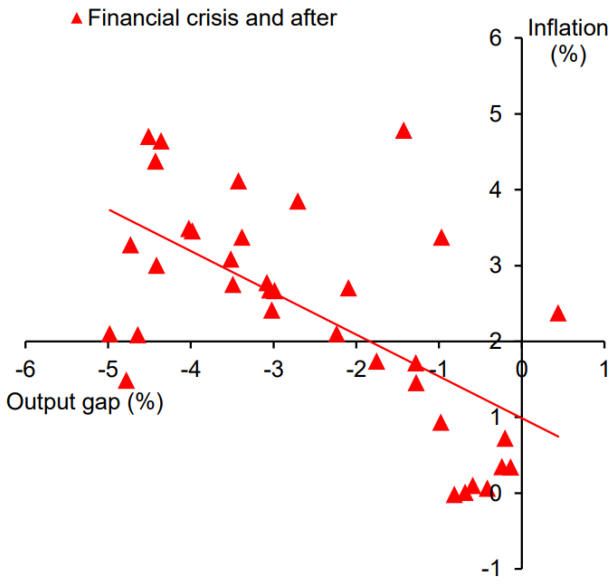
Source: Eurostat, IMF and Bank of England calculations. The measure of inflation is the four-quarter change in the harmonised index of consumer prices (HICP). The output gap is the IMF's estimate from the October 2016 WEO at an annual frequency, interpolated to create a quarterly series.

Chart 16: Inflation and Output Gap (United Kingdom, 1993-2007)



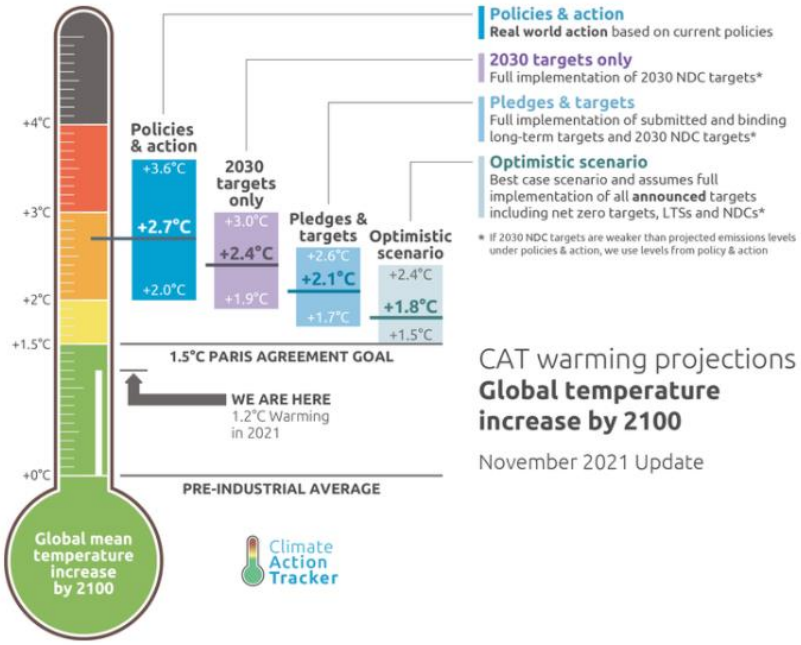
Source: Bank of England

Chart 17: Inflation and Output Gap (United Kingdom, 2007-2017)



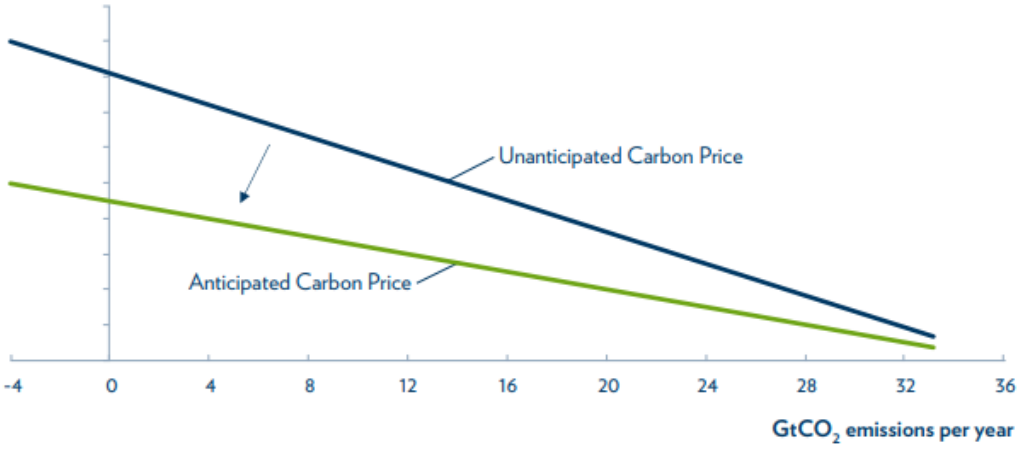
Source: Bank of England

Chart 18: Warming Projections for different levels of policy action



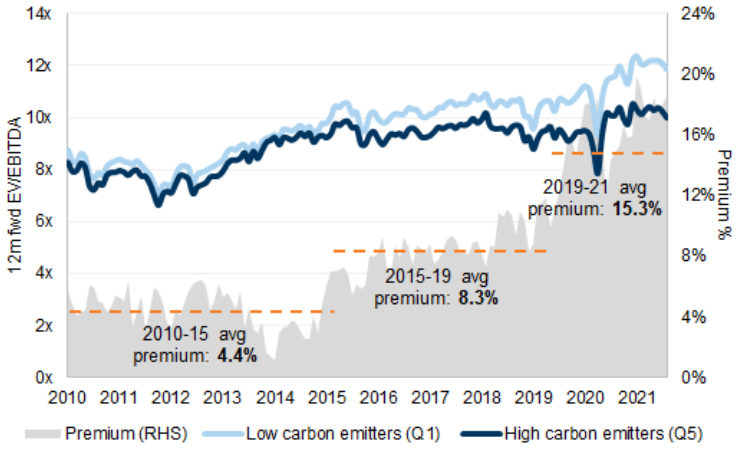
Source: Climate Action Tracker

Chart 19: Credible policy frameworks can reduce the carbon prices necessary to achieve a given goal



Source: G30 Report: Mainstreaming the transition to a net zero economy (2020)

Chart 20: Valuation premium of low vs. high carbon emitters



Source: Refinitiv, FactSet, Bloomberg, Goldman Sachs Global Investment Research