

Summary

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On November 12th and 13th 2021, as COP26 in Glasgow was about to conclude, we convened our Ditchley Park economics conference on 'The politics of climate change'. It was in person for the first time in two years, with some participants joining remotely. Speakers included Joseph Aldy, Agnès Bénassy-Quéré, Arancha González Laya, Zeke Hausfather, Beata Javorcik, Jean Pisani-Ferry, Martin Sandbu and David Willetts.

Our thesis for the conference was that getting to net zero was a political problem as much – and possibly more than – an economic or technological one. Renewables and battery technologies are improving. The International Energy Agency (IEA) has set out a narrow path to net zero using massive deployment of new technology – although there are big questions about the role of hydrogen, carbon capture and storage, and how much energy efficiency could be achieved. We know that pricing carbon emissions effectively would hasten reductions in demand for fossil fuels and the deployment of alternatives. But we also know that the imposition of carbon pricing is politically very difficult, and that climate action is a global collective action problem. Climate action may also reduce growth and have regressive effects – a particular problem for those countries struggling with populist and authoritarian movements that are often sceptical or denialist about climate change. In the US, the Republican Party is largely actively hostile to climate action, but global warming cannot be stopped without the US on board. The politics of climate change will be the most important subject for policy-makers in the 21st century.

At the conference, participants were divided over whether the COP system of multilateral climate negotiations would limit temperature rises to less than 2 degrees compared to pre-industrial levels. National commitments to reduce emissions made at Glasgow still entailed 2.4 degrees of warming, and policies currently in force would result in global emissions remaining flat, rather than falling. But some argued that the COP provided a structured process of commitments and accountability that was imperfect but could be strengthened. Most participants accepted the need for more penalties for free-riding countries, but thought that the design of climate clubs or carbon border adjustment mechanisms should not forestall growth in poorer countries or substitute for aid to help them green their economies. Burden-sharing should reflect the fact that richer countries were responsible for most emissions to date. Climate change could make the world more unstable by sparking contests over resources, destroying agricultural land and raising migration flows. Development policy had to take more mitigating steps to improve food security and prevent flooding and other extreme weather events before disaster struck. In some ways, green energy provided an opportunity for more international stability: while it involved significant investment, it would help more countries achieve energy self-sufficiency, including in Europe.

The conference largely agreed that a simple carbon tax to fully price emissions would not be politically sellable, and a range of policies would be needed alongside carbon pricing. Populist politicians were always looking for wedge issues that they could use to divide 'elites' from 'ordinary people', and climate policy would be the next front in the battle, after immigration. Compensation and subsidies for losers from the green transition were important, but questions over policy design remained. Governments should ensure green substitutes for petrol vehicles and the gas boiler were ready before raising the price of emissions in road transport and domestic heating. Carbon dividends, whereby carbon tax revenues were returned to citizens as cash payments, would help with buy-in. But ultimately, politicians needed to be opportunistic, to implement whatever was feasible. Not all policies worked equally well in different countries.

Participants disagreed about how costly the green transition would be. There was consensus that climate action would be better for most economies than doing nothing and allowing a hotter climate to damage human health and destroy ecosystems, infrastructure, land, buildings and other capital. The economic cost of climate action to keep to 1.5 degrees would be around 1-3 per cent of global GDP annually – a sum that many participants thought could be politically acceptable and would not necessarily reduce living standards, contrary to the arguments of degrowthers. Some participants were techno-optimists, pointing to the rapid fall in the cost of renewables and the fast improvements in battery technology, and arguing that innovation had been rapid when climate policy had been strengthened. There was agreement that governments should be open about the transition requiring more intervention than citizens had been used to.

Session 1: Do states need to use more economic coercion to drive climate action?

At the 21st meeting of the COP in Paris in 2015, states agreed to submit 'nationally determined contributions' (NDCs) every five years from 2020: these plans must describe actions they will take to reach the goal of keeping global warming well below 2 degrees, and preferably below 1.5 degrees. These plans are legally binding, but there has been no enforcement mechanism that sanctions countries that fail to deliver since the UN climate talks began in 1992. Meanwhile, global temperatures have been rising, at around 0.2 degrees a decade since 1960, and global greenhouse gas emissions are now 40 per cent higher than in 1990. Is it time for climate leaders, such as the EU, to impose costs on climate laggards in order to change their behaviour? Should those be unilateral border taxes on carbon-intensive imports – or would multilateral 'climate clubs' more effectively impose penalties on free-riders? Is there any chance of an enforcement mechanism at the global level? Can we meet emissions targets without co-operation with China? And should the West instead focus on providing bigger carrots, through transfers of cash or technology?

Beata Javorcik used the coal industry to illustrate the scale of the global challenge to decarbonise and the possible incentives created by the EU's proposed carbon border adjustment mechanism (CBAM). Coal remained an important part of the energy mix in several eastern EU member-states, and many of the EU's neighbours. Increases in carbon prices would create incentives for EU-based industries to reduce emissions. But if the EU imposed a CBAM, exporters to the EU may respond in different ways: some may make their production process greener to retain market share in the EU; others may redirect exports away from the Union. If exporters outside the EU greened their production in response to the CBAM, this could create a virtuous political cycle. Exporters often produced items for domestic consumption too, in competition with firms that did not export to the EU. Exporters would therefore lobby for European standards to be applied to all domestic producers, to level the domestic playing field. Yet there was a risk of creating a sharp divide between countries that followed this virtuous cycle and those that saw more benefits in looking for markets elsewhere.

Aranha González Laya observed that international relations were increasingly dominated by China-US rivalry, as opposed to Europe's preference for a rules-based order. This change did not augur well for international climate co-operation, although there were glimmers of hope: climate science was increasingly taken seriously; the US and China recognised they must co-operate to address global warming; and a diverse set of groups were pressuring governments for change. But there were three areas of concern. First, the transition for consumers needed to be handled carefully, to minimise the domestic political fall-out. Second, the broader economic transition needed to be negotiated, particularly questions about the use of natural gas and nuclear energy in the green transition. Third, the international community needed to decide how much to spend on mitigation of climate change and how much on adaptation. Funding for adjustment to a changed climate would need to be focused on the poorest countries, on small businesses and on consumers.

Suzi Kerr argued that the world lacked an effective global mechanism to enforce countries' climate commitments. Such a mechanism should identify each country's required level of effort, depending on their national circumstances: for

example, there was broad agreement that richer countries should bear more of the costs of mitigating climate change than poorer countries. The EU's CBAM should be understood as such an enforcement mechanism, rather than an attempt to limit carbon leakage, which was not a serious risk (carbon leakage occurred when companies shifted production to countries with laxer climate policies). The problem was that the CBAM may exacerbate inequality between countries, by penalising those for whom setting a domestic carbon price would be very difficult. Exempting poorer countries entirely would, however, eliminate incentives to reduce emissions. To be more effective, the CBAM should be part of an internationally agreed package with both carrots and sticks – a 'climate club'. Developed and developing countries in the club could agree to different levels of emissions reductions, depending on each member's capacity, and agree rewards if developing countries reduced emissions below a certain level, to create a cycle of increasing ambition. Sticks like the CBAM should play a role in such an approach, but only a small one.

Arianna Vannini noted that the European Commission had adopted the 'Fit for 55' package to deliver the EU's emissions targets. Given the large differences between the EU and third countries in terms of their climate ambitions, Europe needed to avoid risks of carbon leakage. The CBAM could be a useful tool in this respect: while it would initially apply only to limited sectors, it could be expanded over time. The CBAM would be non-discriminatory – it would not provide EU companies with any competitive advantages – and it would comply with the EU's and its member-states' international obligations. In parallel with the CBAM, the EU remained committed to providing assistance to developing countries to help them decarbonise, including through sharing green technology.

The discussion addressed whether coercive approaches could be effective in persuading large economies to reform. Some discussants supported a tougher stance, noting that prohibitions (such as bans on diesel vehicles in city centres) could be highly effective, and prompted innovation.

Others felt that many national governments would find it politically difficult to respond to coercive approaches, because doing so could have harsh impacts on particular communities.

These discussants advocated more public support for decarbonisation, rather than solely relying on revenue-neutral market mechanisms. At the international level, EU member-states could borrow cheaply on financial markets, and fund some of the investments necessary to allow many poorer countries to decarbonise, both inside and outside the EU. Spain's agreed shutdown of its coal industry upon joining the EU was cited as a precedent: Spain received significant EU funds for that transition. China faced a similar problem: many coal power plants had recently been commissioned, and bail-outs would be required to close them without risks for the Chinese financial system. Some discussants felt that, absent a crisis or sufficient financial incentives, India and China would continue to delay their net zero target dates.

Suzi Kerr's proposal for carbon clubs was another focus for discussion. Participants pointed out that developed countries had agreed in the COP process that they bore more responsibility for climate change mitigation and adaptation, and a combination of incentives and disincentives was necessary to deal with free-riding. Some noted that getting

some big emitters on board would be critical for any club to succeed; others suggested that a club between small members would be a useful proof of concept. The close relationship between some developed and developing countries (such as between France and some Indo-Pacific countries) could serve as the basis for such a club, added another discussant. Some noted that any club involving both the US and China would have enough influence to change prices internationally, which might convince many more countries to decarbonise. There was some concern that, compared to the US and China, Europe would find it difficult to successfully implement a CBAM unilaterally. If climate clubs involving the US and China did go ahead, the EU's attempt to deploy the CBAM might be superseded. Sceptical discussants noted that countries used different approaches to climate policy, with some relying more on regulation than price signals, so it would be difficult to compare countries' efforts in carbon clubs with any objectivity. Other discussants thought that both the CBAM and carbon clubs might have a role, and should be considered as part of a broader toolkit of international strategies.

Session 2: Can governments deliver?

The economy must be transformed in order to contain rising global temperatures. To do so, higher prices or restrictions must be imposed on polluting activities, creating losers who will make their voices heard. In addition, those who will bear the harshest consequences of climate change live in poorer parts of the planet, raising questions about whether citizens of richer countries will shoulder their share of the burden. And in democracies, short election cycles and the rise of populism may weaken governments' resolve. Is the threat from climate change big enough to force democracies – and autocracies – to act quickly? Might democracies better manage competing interests than autocracies when designing climate policies? Can the developed world – especially the US – find consensus on how to fight a long-term problem? Can independent domestic institutions hold governments to their climate commitments? And does rich countries' beggar-thy-neighbour approach to the COVID-19 pandemic suggest they will do too little to help developing countries confront climate change?

Joseph Aldy said it was hard to tell whether the US could deliver on its climate commitments, because there were political and legal risks. The US had only met its emissions target in 2020 thanks to the pandemic, although, by 2019, the electricity sector had cut emissions by 33 per cent from 2005 levels. A complicated patchwork of US policies had emerged, with tax credits and other subsidies for low emissions technology; regulation forcing companies to meet specific standards or use specific technologies; and cap-and-trade regimes at the state level meant one-third of US citizens consumed electricity that was subject to a carbon price. But climate action was a highly partisan issue, and with a divided Senate, Joe Biden's 'build back better' bill might include \$500 billion of spending on clean energy but was unlikely to include a clean electricity standard or national carbon pricing. That led to legal risks: without such legislation, Biden would need to use executive authority to regulate emissions in the power sector. Obama's executive order doing so had been overturned by the Supreme Court, which said that legislation was needed. The conclusion: it was best to use a 'belt and braces' approach, with overlapping efforts at state and federal level, and both legislation and executive orders.

Catherine Fieschi discussed the politics of climate action in the aftermath of the *gilets jaunes* (yellow vests) movement in France. Populists might turn to climate policy for their next line of attack, and the outcome would be increasing polarisation with both climate sceptics and activists attacking governments. Climate policy could become a 'wedge issue' for populists as immigration had been previously: populists could say that climate policy served elite interests; that it was technical and abstract; and that policy-makers disdained or ignored the interests of ordinary people. Marine Le Pen's spokespeople had used some of this rhetoric, but it was not just the populist right that adopted this stance – the candidates on the mainstream right in France sounded similar. However, dissent was also coming from climate activists demanding more from governments, businesses and households. Shareholder activists were forcing corporations to change, and legal activists were suing both governments and corporations, sometimes successfully. And in the run up to COP26, a different kind of activism had started to emerge; not protests and crude slogans, but one that was more focused on policy, with knowledgeable activists picking apart the announcements governments made. Activists

were predominantly young, female and non-white, and were bringing questions about financing the transition in developing economies to the fore.

Tessa Khan said that, in 1992 at Kyoto, governments committed to stop dangerous anthropogenic interference in the climate, but since then, greenhouse gas emissions have continued to rise. And in Paris in 2015, they promised to keep temperature rises below 2 degrees and preferably 1.5 degrees, but pledges in Glasgow would only achieve between 2.4 and 2.7 degrees. There was no enforcement mechanism at the international level, so it had to happen nationally. The UK's Climate Change Act was a good example of a commitment device, because it included five-year carbon budgets that must be met, with an independent Climate Change Committee regularly reporting on the government's progress. In countries without such effective national legislation, activists were turning to courts to enforce international commitments. Cases had been brought against governments and corporations in the Netherlands, France, Germany and Belgium, compelling them to act on their commitments. Litigation was a powerful tool for putting facts on the record, making it clear that governments and fossil fuel companies were the actors that bore overwhelming responsibility for failing to reduce emissions.

Jean Pisani-Ferry agreed that climate policy had a big credibility problem. The IEA found that current commitments would reduce emissions by 40 per cent globally by 2050, rather than to net zero. And the policies currently in place would keep emissions flat between now and 2050, rather than reduce them. The immediate costs of action were high, and benefits would come later; and there were big incentives to free-ride on the climate commitments of other countries. An array of political techniques was being used to press for more action – all imperfect, but such a patchwork was probably the best we could do. The COP system, economists had argued upon its inception, was unlikely to work. But the system had had some successes: its credibility was high enough to encourage private investment in green technology. Improving credibility required better national institutions, as Tessa Khan had said, and also governments ensuring that investors in green technology would get a sufficient return. Possibly we needed central bank-type institutions, setting limits on the quantity of carbon emitted, and determining what the price of emitting carbon would be to achieve that limit. The Fit for 55 package was a big risk for the EU: it was a strong commitment device, but also a gamble, because the EU traditionally promoted integration for positive-sum outcomes, rather than pursuing policies that had profound distributional consequences.

The discussion that followed focused on four issues: how governments could best provide commitment devices that would convince markets to invest in green technology; whether governments and citizens should consider climate policy to be 'costly', given the enormous costs of inaction; the probable tactics of climate sceptics; and how climate activists could best press their case.

There was a fair degree of scepticism about the credibility of the COP process. One participant noted that many governments had made COP pledges that were not enshrined in NDCs, such as Jair Bolsonaro's commitment not to deforest the Amazon. Pledges were difficult to monitor in any meaningful way, unlike NDCs, which were formally monitored by the Intergovernmental Panel on Climate Change (IPCC). Another said that the problem facing European governments was that the action they took would have less impact on global emissions than the US or China, which left them open to the climate sceptic argument that national action was pointless.

As for action at the national level, one attendee noted that it was a good idea to provide compensation and subsidies up front and then slowly raise carbon prices and strengthen regulation, because action had to happen now to deliver benefits in the future. A participant said governments faced difficult choices between technologies – choosing between hydrogen and electric technologies in some sectors was tricky. Governments should consider stronger incentives for innovation, argued another participant, saying that prizes, regulation, intellectual property reform and subsidies could all encourage more R&D. Several people argued that governments should be willing to use low interest rates to borrow for the transition, with one pointing out that debt-financed climate action would reduce the debt-to-GDP ratio in the long run, because we would avoid the fall in GDP (and tax revenues) that was inevitable with runaway climate change.

The conference largely agreed that inaction was the baseline for determining whether climate policy was costly – reducing emissions would raise GDP and living standards compared to doing nothing. One participant said that there were several policies that would both raise welfare and curb emissions, such as stopping fossil fuel subsidies. He added that most methane emissions could be captured at a profit, and most new investment in renewables would be more profitable than fossil fuel power generation. But one of the panellists countered that the transition would require an extra 2-3 per cent of GDP in investment for two to three decades, which had to imply forgone consumption: to argue otherwise meant incredible slack in the economy or improbable productivity gains.

Many discussants agreed that climate policy would inevitably be polarising. Part of the problem was a policy vacuum, argued one participant, and we needed left- and right-wing thinking on climate. Right-wing arguments about preserving freedom across generations could help to motivate conservative voters for example. A discussant said that people often discounted the future, and tended to ignore intergenerational arguments. He added that the transition was a decades-long affair but the rhetoric was all about immediate deadlines, which undermined the coherence of climate activists' rhetoric. Activists should focus on mass mobilisation, said another participant, citing scholarship saying that change was more likely to come if over 3 per cent of the population became involved in the issue, be it via direct action, making placards, or doing bake sales. The key was to create a sense of moral crisis, as the African-American

civil rights movement had done by marching with children towards water cannons and police dogs.

As for climate sceptics' activism, one discussant noted that there was a transatlantic divide, with US Republicans denying the science, but many European right-wing parliamentarians saying that they were not denialists but merely worried that the costs were too high or would not be distributed fairly.

Another cautioned that we should not assume that would always be the case: the *gilets jaunes* started under moderate sceptic leadership but then became more radical. In response, argued another discussant, governments could – and should – be realistic and credible, and should say that there is a desirable future ahead but getting there would require a degree of government intervention that we were not yet used to.

Session 3: How can European governments ensure that climate action does not penalise poorer citizens?

To achieve climate goals, the way we produce goods, move around, build and operate infrastructure, and keep warm or cool must be transformed. Both the EU and national governments will have to make regulations more stringent, increase carbon prices and broaden their coverage. But policy-makers worry that the costs of ambitious climate action will disproportionately fall on poorer citizens and regions. Will climate action have similar economic and political effects as deindustrialisation has had, such as higher unemployment in poorer regions? Will the redistribution of income be enough to ensure a just transition, or should governments redistribute more opportunities – for workers to retrain or to move to more successful regions, for example? Or do economists have it backwards: will regulations and carbon prices meet too much political resistance, and should we instead put more emphasis on public investment to fight climate change?

Eric Lonergan said the main policy challenge was to make electricity generation sustainable – for which technologies already existed – and to electrify transport, buildings and manufacturing as much as possible. That would reduce emissions by around 75 per cent. Looking at it that way, he argued, it was curious to see most of the economics literature focusing on carbon pricing: unless there were substitutes for high-emissions technologies like the internal combustion engine, raising their prices would simply lead to a political backlash. The focus, he argued, should instead be first on collapsing the cost of capital for energy investment, by providing cheap funding and by the state taking on some of the private sector risk. If firms used market interest rates and had to bear the full risk of low-carbon investment, there would not be enough investment to eliminate emissions. Policy-makers' second focus should be to reduce the price of green alternatives with subsidy, and where no alternatives existed, they needed to be developed with the support of the state.

Agnès Bénassy-Quéré started with France's 'yellow vests' protests against higher petrol prices, which had risen by a modest €5 per week for regular drivers. Petrol prices had triggered the protests, but were not the underlying cause. According to research, the main factors driving the protests were local unemployment, closure of the last local grocery shops, and self-reported unhappiness and distrust of the state. One lesson was that people needed to trust that carbon taxes would be redistributed fairly. Trust could be enhanced by paying money to citizens first and taxing carbon emissions later, or through more transparency in how carbon tax revenues were allocated. Regional governments also needed to benefit financially from climate efforts that they were responsible for, rather than solely taking blame for costs imposed on citizens. Citizens may also have a different concept of equity that was incompatible with carbon pricing:

an 'equity of effort' in which the rich should not be able to buy themselves more opportunities to pollute, because they could afford carbon prices, but should chip in equally. That was why regulation was more popular, and why politicians needed to promote examples of good, climate-friendly behaviour.

Martin Sandbu argued that the climate transformation was hitting the same people and communities as deindustrialisation had: a higher share of poorer households' spending was carbon-intensive; the decarbonisation of industry would probably lead to lower employment in that sector; and services-oriented cities would do better than industrial towns, in part because urban lifestyles were more in line with tougher climate policies. A carbon dividend, whereby carbon taxes were redistributed to citizens, was an essential policy, he argued: the net beneficiaries of the dividend would become a political constituency in favour of a higher carbon price. With the right design, a carbon dividend could ensure that almost everyone in the bottom 50 per cent of the distribution was better off, for example by paying more to people who lived outside cities, to compensate for their higher transport costs. In Canada, a dividend system had led conservatives to drop their opposition to carbon taxes, because taking dividends away was politically unattractive.

Thomas Sterner argued carbon taxes worked: higher petrol and diesel taxes in Europe, which made up roughly two-thirds of the fuel price, meant fuel consumption was about one-third that of the US. The effects of climate change would mostly hit the poor globally, while a fair distribution of carbon permits would allow poorer countries to earn substantial revenues if they sold surplus permits. But if the world started compensating entire countries or groups of people, the list would get too long. He reminded the conference that fuel taxes were progressive in most countries, and at least

equally borne by rich and poor in high-income countries. Sweden's 'yellow vests' were in favour of policies to fight climate change, and even in favour of carbon prices, as long as everybody paid equally, but they were opposed to subsidies that mostly benefitted the rich, like those for electric cars. In the 1990s, when Sweden's carbon taxes were introduced, the consensus was not to tax all activities in order to make the tax easier to sell politically. But with voter concerns about fairness, that approach may need rethinking.

The discussion mostly revolved around different conceptions and perceptions of fairness. Rethinking the concept of equity was important, argued one discussant, and 'equity of effort' was probably the best frame. But another cautioned that the 'polluter pays' principle behind carbon taxes was, in fact, about fairness, with people paying according to how much they damaged the environment.

Some participants worried about the effects on equality of subsidising changes in behaviour. Handouts to insulate homes or buy electric cars mostly benefitted the rich, argued some, with one pointing out that there were more electric vehicle charging points in richer parts of the UK. One asked whether the state had to be more active in offering decarbonisation as a public service, to promote take-up among lower-income groups.

Government backing for the development of low-carbon substitutes was crucial for public support, and cash compensation was not enough, some argued. The lack of substitutes for internal combustion engines had been a repeated complaint during the yellow vest protests. Instead of financial compensation for higher carbon prices, the focus should be on helping citizens to replace their brown capital goods such as old cars. One discussant countered that substitutes like public transport or carbon-free heating already existed, and that deploying the technology was not a hard problem to solve.

The conference discussed what forms of compensation would maximise support for climate action. A perfect system of redistribution with richer polluters paying poorer people was not obviously preferable, argued one: people differed on what was fair, and it was best to subsidise those voters that were needed to maintain support for climate action. Another disagreed: in order to maintain political support, we needed buy out the lower half of the income distribution. We

knew from experience that unconditional cash transfers were popular, and that meant that we should 'overcompensate' households, by giving them more money than carbon taxes brought in, at a fiscal cost. Another pointed out that in Canada, cash transfers had made climate measures more popular, but not by much, despite overcompensating for the carbon tax. One potential reason was that Canadians were given tax rebates, rather than being sent cheques together with their energy bills, so many did not associate compensation with carbon taxation. One participant observed that cash compensation was popular, but not as popular as using the funds for climate purposes.

The divide between cities, towns and countryside played a crucial role in the resistance against climate action, said one discussant. Most of those mobilised by the protest movement in France, for example, were car commuters, unlike city dwellers. Another argued that involving the local community could build trust, citing the example of how Ireland ended peat cutting with popular support. Compensating the loudest groups was the wrong way to go about fairness, she added. One discussant stressed that linking climate action to local benefits, such as good jobs, would raise support.

How costly climate action would be was controversial. Some disagreed with the argument that the cost of de-risking green technologies was limited, as was developing substitutes for carbon-intensive goods. But it may be a 'professional deformation' of economists to think that the climate transition must have a high cost because we were moving the economy away from the current market equilibrium, said a discussant. Another participant argued that there was no GDP cost to climate action, as preventing climate change was economically beneficial. However, there was a cost in the form of lost consumption today to finance green investment, and there would be winners and losers in the fight against climate change.

A fitting summary was provided by one discussant, who observed that four very smart panellists had come to entirely different conclusions about what needed to be done. That led him to believe that there was not one concept of fairness and that what was perceived to be fair policy was neither obvious nor the same across countries or years. Policy-makers, then, needed to be opportunistic, examining the whole menu of options and implementing whatever seemed feasible.

Session 4: Will climate action raise economic growth?

The 'degrowth' movement argues that economic growth is incompatible with the sustainable use of the Earth's resources. The movement's critics respond that shrinking the global economy is unnecessary and would in any case be impossible for governments to impose, and that 'decoupling' growth from environmental damage is possible. It is obvious that climate action will raise global GDP in the long-run, compared to doing nothing, because unfettered global warming will destroy the environment. However, it is uncertain whether investment in green technologies will be growth-enhancing: renewables may provide more abundant cheap energy than fossil fuels, for example, or buildings insulation might reduce fuel bills, raising real incomes in the long-term. But green public and private investment will have to rise by 1-2 per cent of GDP annually to meet emissions targets, and must be funded through foregone consumption, more rapid productivity growth or borrowing. Are technologies available that are compatible with sustainable growth, or will we reach the physical limits of environmental resources? Which policies would promote both the sustainable use of resources and higher living standards? What should governments do if the climate transition causes growth to stall?

Paul Ekins said the IPCC scenarios indicated that the economic cost of climate action to keep the global temperature increase to 1.5 degrees would be small, around 1-3 per cent of global GDP annually. He argued that modelling scenarios did not show that 'degrowth' was inevitable, or indeed likely. Decarbonisation might slow economic growth if zero-carbon energy were more expensive than fossil fuels, if decarbonisation slowed technical progress, or if minerals and other resources needed for zero-carbon technologies became geologically or geopolitically scarce. However, zero-carbon energy was already cheaper than fossil fuels, and decarbonisation was encouraging investment and technical progress. Finally, he said that recycling could mitigate the scarcity of minerals. He indicated however that social and environmental governance of mining and refinement would need to improve drastically.

Zeke Hausfather said that the decoupling of growth and greenhouse gas emissions had already happened in various countries, and it was not down to the outsourcing of carbon-intensive production to developing countries. Zeke argued that full decoupling of economic growth and emissions had become possible because the costs of solar, wind energy and batteries for electric vehicles had declined so much. These increasingly affordable technologies could displace fossil fuels without sacrificing too much convenience for consumers. The IEA estimated that more than half of the emissions reductions required to remain in a 2 degree scenario would need to come from technologies currently in the prototype or demonstration phase. He argued that we would need to invest in developing new low-carbon technologies as well as deploying mature low-carbon technology. The evidence of decoupling so far showed these technological changes could be achieved without impairing growth.

Janneke de Vries argued that we should ask whether the current rates of economic growth could be sustained without tackling climate change. She cautioned that most economic models did not consider the economic cost of inaction on climate change, by ignoring the damage from hotter temperatures and more violent storms, and thus overstating economic growth in a business-as-usual scenario. She said that avoiding climate action would have a larger

negative impact on global GDP than achieving the Paris Agreement goals, and that the hit to economic output from climate change, which was already causing natural disasters, would be larger in poorer countries. Janneke argued that the challenges of the energy transition were easier to solve than the increasing scarcity of natural resources, particularly fresh water, which had no substitutes. Shrinking freshwater reservoirs would have repercussions for agriculture, and hence the security of the food supply. She argued that the social unrest, conflict and migration caused by food insecurity would have an obvious negative impact on GDP.

David Willetts declared himself a techno-optimist: while the effects of climate change were becoming increasingly acute, the speed of technological progress required to counter them was accelerating. David indicated that energy transition costs were sizeable but not massive: investment needs in the UK had been estimated at around £1.4 trillion over 30 years, but given operational savings (for example from energy efficiency), the net overall cost would only be £300 billion. Instead of technological risks, the policies required to incentivise cuts to emissions were the real challenge. He argued that there needed to be a balance between the two main alternatives – regulation and price signals – and more attention paid to the distributional consequences of the latter. Lastly, he suggested that in the UK, the benefits of the energy transition might not be skewed towards wealthy urban areas: jobs in retrofitting buildings would be distributed across the country, and offshore wind, tidal power and carbon capture and storage would all be located outside the wealthier south-east of the country. He concluded that the idea that we would need to give up on growth to act upon climate change was misplaced, and that the green agenda might well contribute to 'levelling up'.

Many participants in the discussion were also techno-optimists, but with some caveats. Behaviour changes were needed to drive innovation: new technologies would be invented in response to increases in the costs of polluting. Furthermore, emission cuts would become more difficult as the lower-hanging fruits were reaped – for example, decarbonising heavy industry would be technically more challenging and costlier than decarbonising the electricity

sector. The availability of critical materials may constrain the supply of some technology, such as batteries, until costly recycling systems were set up. In this respect, a participant indicated that the challenge was finding a growth pathway that matched various constraints – greenhouse gas emissions, but also water scarcity and the availability of other natural resources.

Some participants indicated that decarbonisation may not reduce or stop economic growth, but it might change the composition of GDP, as it would require a higher share of investment to GDP, thus reducing consumption. This may not translate into lower absolute consumption levels, but it might be perceived as lower well-being, as consumption habits would need to change. Others argued that a more 'dematerialised' economy, with higher investment in public services, a cleaner environment and better public health, might instead increase well-being.

Several participants pointed out that the transition would lead to 'stranded assets' – assets that would no longer be profitable with tougher climate policies and would need to be scrapped before the end of their useful life, particularly in the fossil fuel sector. The question was whether public intervention was needed to compensate the owners of stranded assets and workers in fossil fuel industries.

A participant asked why, if clean technologies led to more abundant and cheap energy, markets had not delivered clean technologies before. There were various possibilities: high

up-front costs of new infrastructure, co-ordination failure at government level, and the risk that investments in new energy technology might get expropriated by governments. One discussant said that there were specific barriers to the roll-out of renewables, including complicated planning laws. On the technical side, the intermittency of renewables required adaptation in the power grid. The exploitation of offshore wind power had been made feasible thanks to very recent advancements in sensor technologies. Friction in the adoption of new green technologies could also be explained by the important role of the fossil fuel industry as an employer in many countries.

Others added that the lack of carbon pricing slowed down technological innovation, as carbon prices remained low in most regions which applied them, and were negative globally due to fossil fuel subsidies. Some argued that carbon prices should be considerably higher to meet Paris Agreement goals, and that setting a pathway for carbon prices in the medium and long run would provide clarity to investors in new technologies. At the same time, a participant worried that, as increasing carbon prices inevitably affected energy costs, short-term growth may suffer.

A participant argued that policy sequencing to encourage innovation was key, and that frontloading subsidies for the development and adoption of green technologies might be better than raising carbon prices. He argued that driving down the prices of green alternatives was critical in ensuring consumer adoption.

Session 5: Will climate change – and action to stop it – make the world more unstable?

Climate change will affect some parts of the world more than others. Some regions may become almost uninhabitable or have much more volatile agriculture yields, driving food prices and political instability. Water sources may become such a precious resource in some parts of the world that countries may contemplate going to war over access to them. Some waterways and natural resources in the Arctic, if free of ice, could become exploitable, leading to new competition for resources and control over trade routes. The policies to contain climate change will also have uneven effects: countries rich in fossil fuels will lose revenues, while countries with large swathes of tundra may find their land to be more productive than it was. How will the effects of climate change – and climate action – affect geopolitics? Which regions will be most affected? Is it inevitable that the world will become more unstable? Can the US, China and the EU work together to mitigate the geopolitical fallout from climate change? How should the EU ensure its foreign, security, trade and development policies will still deliver their goals in light of climate change?

Heather Grabbe argued that climate action, not just inaction, would contribute to global instability. Economic models rarely incorporated the consequences of depleting global resources, such as population displacement. Total resource usage would double by 2060 unless the world learned to 'dematerialise' the economy, to reduce the transformation of natural resources into goods and then into waste. There were three significant sources of global instability that would arise from any failure to dematerialise the economy. First, greater geopolitical competition would develop as China and the US vied for control over critical supply chains. Second, climate action would inflame existing conflicts over resources: many key

resources needed for low-carbon technologies were in conflict-prone areas. Third, resource extraction would directly cause environmental crises, which would have effects across borders, for example by impacting fragile cross-national ecosystems.

Stéphane Hallegatte noted that the full impact of climate change was uncertain and could not be understood in isolation from other environmental stresses, for example population growth. Predicting where climate change would cause conflicts was therefore difficult. As an example, some countries would see reduced food production and food insecurity; others may see higher food yields. International

co-operation would be essential to manage these changes, especially to ensure resilient trade in food, and to mitigate the effects of climate change upon vulnerable communities. But disaster response should not be the only help the international community provided: taking steps to protect coastal areas at risk from rising sea levels was essential, rather than waiting for a crisis. In some ways, green energy provided an opportunity for more stability: while it involved significant investment, it should ultimately help more countries achieve energy self-sufficiency. Once the green transition had happened, the world would probably be more stable than it was now, but in the meantime there was greater potential for conflict.

John Sawers emphasised that the developed world was focused on extreme weather events, but in the developing world, the more insidious impacts of climate change were long-term: on average temperatures, rainfall patterns and soil quality, for example. Some places would consequently become incapable of sustaining their populations. Migration would become a significant driver of conflict, as it had in Turkey and on the Poland/Belarus border. Wealthier countries – such as Saudi Arabia and the UAE – should be able to move away from oil and gas extraction without causing migration crises, given their financial resources, but poorer countries would be far less able to do so. Richer countries might seek to strengthen borders in response to these crises, but the developed world must learn to manage large-scale migration, and understand climate change as a humanitarian crisis. Advocates of the EU's CBAM should therefore be mindful that developing countries may perceive it to be a form of 'climate imperialism'. A new funding model – with a new institution, which John thought could be similar to the 'International Bank for Reconstruction and Development' – may be a better way to help vulnerable countries adapt.

Nathalie Tocci said that governments tend to 'tack on' climate change to existing foreign policy and security challenges. Europe is spending vast amounts on stability in its surrounding regions without properly considering how climate action might affect its priorities. In the Sahel, for example, the EU's priority was migration management; the EU would fund very different projects if climate adaptation were its objective. The EU should also consider which nearby countries would be worst affected (such as Algeria, Nigeria and Libya) and which countries had green opportunities that EU investment could unlock (such as the production of solar energy and green hydrogen in Morocco). More broadly, global power would be more diffused in a low-carbon world. That offered opportunities for Europe, for example to reduce its dependence on foreign energy. But the EU must not focus on economic decoupling entirely: for example, it was not viable for Europe to achieve its carbon objectives without co-operation with China. And, similarly, the EU needed a transatlantic dialogue: it should be more flexible on carbon pricing and the CBAM, while the US needed to show more flexibility on the taxonomy debate.

The discussion also addressed the distinctions between countries which needed assistance and those which should

assist others. One possible distinction was between carbon producers with large sovereign wealth funds and those who lacked such resources – although another discussant pointed out that these countries' degree of vulnerability depended on whether the wealth funds had been used to diversify the economy. Others noted that different distinctions were important: for example, the cost of transition varied greatly between countries; and some countries like Azerbaijan had long-term resources contracts which would help them bridge the transition. Gas-exporting countries would also be better off than oil exporters, since gas countries had more time to diversify. There was general agreement the world needed a consistent set of metrics and taxonomy, to help build a common understanding of countries' positions and their required efforts.

The conference also returned to the CBAM in this session. Some discussants felt that, although the EU insisted the CBAM was consistent with international trade law, other countries would perceive the mechanism as a unilateral move and also act unilaterally, undermining the global trading system. Another discussant felt that the CBAM was consistent with the trend away from multilateralism in international trade, and noted that the EU's frequent references to 'sovereignty' were also used by developing countries, such as Brazil, when permitting the clearing of rainforests. Other participants felt that, although the CBAM would have a narrow scope, it provided an important signal to the market and should be accompanied by other mechanisms to help developing countries. The CBAM may have had successes even before being implemented: for example, it may have influenced Russia and Turkey's recent commitments to reduce emissions.

The proposal for a new international institution for climate financing proved divisive. Some discussants noted that the IMF was providing climate-related loans, and developing countries' constraints were fiscal: they would need grants and debt relief, not loans. That required bilateral agreements, not multilateral institutions. Another discussant noted that international institutions and governments needed to integrate climate adaptation and broader development aid. A separate climate-focused institution would probably not achieve this. Others thought that some degree of institutional change was necessary, since China might grow increasingly concerned that existing multilateral institutions did not properly reflect its geopolitical importance.

On the topic of China, there was considerable pessimism. Discussants asked how consumers in rich countries could be asked to change their ways when China wanted to focus on growth, and whether China would realistically curb its growth when it was the basis of the Chinese government's legitimacy. Discussants agreed that China faced a particularly difficult transition – for example, given the young age of most of China's coal plants and the government's concern for stability. Optimists noted that China would also be concerned about long-term stability, which climate change threatened, and felt that China had the potential to manage questions of intergenerational equity better than some democracies in which the interests of older voters were predominant.

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