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The 2021 biennial exploratory scenario on the financial risks from climate change

A submission to the Bank of England by the Grantham Research Institute on Climate Change and the Environment at the London School of Economics and Political Science, the Grantham Institute – Climate Change and the Environment at Imperial College London, and University of Edinburgh Business School

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About this submission: This is a response to the discussion paper *The 2021 biennial exploratory scenario on the financial risks from climate change*, which was published by the Bank of England in December 2019. This response has been prepared by authors from the Grantham Research Institute on Climate Change and the Environment at the London School of Economics and Political Science, the Grantham Institute – Climate Change and the Environment at Imperial College London, and the University of Edinburgh Business School. The authors have responded to the questions within their remit of expertise only. The response was submitted to the Bank of England on 18 March 2020.

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This policy paper is intended to inform decision-makers in the public, private and third sectors. It has been reviewed by at least two internal referees before publication.

Summary recommendations

- The 2021 biennial exploratory scenario (BES) exercise represents an important step forward for the Bank of England's response to climate change. Its results will not only enable an understanding of the positioning of different firms in the face of the risks posed by climate change, but it will also contribute to knowledge of the overall resilience and stability of the UK financial system over the coming decades. The 30-year horizon for the BES is a welcome innovation and aligns the exercise with the UK's legal commitment to reach net-zero annual emissions of greenhouse gases by 2050.
- The BES exercise could be strengthened by more clearly anchoring its design to the Paris Agreement and the conclusions of the Intergovernmental Panel on Climate Change (IPCC), notably its recent special report on *Global Warming of 1.5°C* (IPCC, 2018). Specifically, the scenarios need to be rooted in the goal of the Paris Agreement of "holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels".
- It should be noted that the BES exercise is not strictly a stress test because the scenarios are based on central assumptions and do not include the lower probability and higher impact consequences. The exercise could be further strengthened by moving away from the central case approach of physical and transition risks. A stress test that does not assess resilience to tail risks could be counterproductive by hiding potential exposures and vulnerabilities. The BES exercise should include higher impact and lower-probability physical and transition risks. This would mean including thresholds and non-linearities and capturing climate, social and policy changes lying outside the central estimates of the probability distributions.
- Assessing a firm's resilience under different future scenarios is complicated by deep uncertainties around climate change impacts, socioeconomic pathways and technological progress, as well as by the fundamental limitations of currently available modelling techniques (see e.g. Chenet et al., 2019; Stern 2016). It is important that the Bank of England recognises those uncertainties and includes sensitivity analyses of the underlying assumptions and parameters in the BES exercise. Given the inherent limitations of different models, much of the work will need to be carried out by complementing the exercise with supplementary tools and expert judgements, as well as by qualitative understanding of the results. This would highlight the value of the exercise as an organisational learning exercise rather than as a tool that generates conclusive results.
- The requirement for participants to submit the 'temperature alignment' of their balance sheets and portfolios is a major and welcome innovation. This will help firms, consumers of financial products, regulators and policymakers to develop a better understanding of how large financial institutions are positioned in terms of transition pathways. The Bank should consider publishing an overall temperature alignment score for the entire UK financial system, separating where possible the score for UK-related assets and assets held by UK firms that are held overseas. The Bank should also explore how regulated firms in the banking, insurance and other sectors can make the reporting of their temperature alignment scores a routine and expected part of their annual disclosures, for example in line with the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD). In addition, the Bank should work with other regulators, notably the Pensions Regulator and the Financial Conduct Authority, to make sure that this crucial information is made easily available to beneficiaries and savers, for example, as a requirement in regular statements on pensions and Individual Savings Accounts (ISAs).
- The results of the BES exercise could also provide profound insights into how climate change could impact the UK's financial resilience at a regional level. For example, geographical concentrations of risk, arising from either the net-zero transition or the physical impacts of

climate change, could be identified for specific parts of the country. This would assist planning by both financial firms on their commercial response to the risks, and by policymakers to ensure that the transition does not have the unintended impact of leaving some communities behind. The Bank of England's network of offices across the country could be usefully deployed to communicate the regional results of the BES exercise to key stakeholders in business, finance, local government and civil society (including trade unions).

Responses to selected consultation questions

Q1. Are there areas of the financial system that should be represented in the 2021 BES that are not captured by the proposed participation?

To establish a comprehensive view of the challenge of climate change, other parts of the UK financial system should be included, notably:

- Equity capital markets (e.g. the London Stock Exchange)
- Debt capital markets
- Pension funds
- Fund managers

To do this, the Bank of England should work together with The Pensions Regulator and the Financial Conduct Authority to ensure that an equivalent exercise is conducted by these bodies, ideally within the same timeframe.

Q3. Are there any other scenarios that the Bank of England should be testing as part of the 2021 BES?

When choosing and designing the scenarios to explore within the BES exercise, there are several key issues that should be considered carefully. In particular, uncertainty is a fundamental consideration in estimating both physical and transition climate change risks.

It should be recognised that the full range of both physical and transition risks cannot be captured in just three scenarios because of the significant uncertainties around the many variables controlling potential future physical and transition risks. The proposed BES exercise would consider variations in just one overall factor, namely policy action, but ignores other important factors. For instance, Paragraph 2.7 of the discussion document states:

> *Each scenario would be a prudent estimate of underlying climate and transition pathways. For example, the scenarios would assume limited development in carbon capture and storage technologies and would take a conservative approach to the sensitivity of temperature to increases in emissions. As a result, the scenarios would not be forecasts of future paths for climate and macro-financial variables. Rather, they would be possible scenarios about what could happen under certain assumptions. In conjunction with climate scientists, the Bank will develop a high-level view on the probability that impacts aligned with each scenario will crystallise. Firms will also be asked to set out their own expectations for future climate change driven scenarios.*

It is important to recognise climate sensitivity (usually expressed as the transient climate response or equilibrium climate sensitivity) as an important source of uncertainty. The Fifth Assessment Report published by the Intergovernmental Panel on Climate Change (IPCC) in 2014 concluded that the value of the transient climate response is likely (i.e. probability of at least 66 per cent) to lie between 1°C and 2.5°C, and the value of the equilibrium climate sensitivity is likely to be between 1.5°C and 4.5°C. If the BES exercise uses anything other than the upper value of the ranges of climate sensitivity then firms will not be considering the true extent of the physical risks they may face, and the Bank will not be assessing their actual resilience. Crucially, it may mean that firms do not consider the consequences of breaching critical thresholds in the climate system, such as destabilisation of the land-based polar ice sheets, which would have serious implications for the magnitude and nature of physical risks.

Furthermore, the Bank should acknowledge in the BES exercise that scenarios might differ due to variations in the structure of the models that are used, and the specific parameters that are provided as inputs. There are also some important aspects of the assessment of physical damages

and mitigation options that are not represented in models, but that should still be taken into account in the BES exercise.

Similarly, there are uncertainties around the rate of development of technologies and practices that influence the rate of the transition to net-zero emissions. The Bank should consider that the way climate policy will unfold in the future is also unclear and that there are some fragmented developments in climate policy already happening across the world that do not fall in the schematic representation offered by the three BES scenarios. We present further analysis of these challenges below.

Considering scenarios that do not assume central estimates of climate change parameters

As the discussion document makes clear, the proposed BES exercise will use "prudent" and "conservative" estimates of some of the factors controlling physical and transition risks.

An approach of this kind necessarily means 'extreme' scenarios are typically disregarded or inadequately taken into account in terms of both physical and transition risks. It also means that some disruptive technologies that might play an important role in the late policy action scenario are assumed to have limited development opportunities.

As the Bank of England acknowledges, conventional stress testing is not usually focused on central case projections, but instead on severe outcomes that could have a detrimental material impact on the financial system (BoE, 2016). The objective of a true climate change stress test would measure to what extent the financial system is vulnerable and resilient to extreme risks lying in fat-tailed probability distributions. The risks associated with a global temperature increase of 3°C or more would have major consequences for societal and economic activities, with limited potential for adaptation (IPCC, 2014). There is also growing evidence that important thresholds in the Earth's climate system could be breached at a global average temperature rise of 1°C above pre-industrial levels. When a threshold is breached, major impacts accelerate or become irreversible or unstoppable. A breach of one threshold could have a cascade effect that leads to other thresholds being crossed (DeFries et al., 2019).

Therefore, if the BES exercise is to be a true stress test, it would need to include scenarios and assumptions that take account of tail risks and thresholds. As some studies have shown, much of the risk for the financial system exists within the tail of the probability distribution. For instance, Dietz et al. (2016 found that the expected climate 'value at risk' (VaR) of global financial assets today is 1.8 per cent along a business-as-usual emissions path – equivalent to US$2.5 trillion. However, in the tail of the distribution, the 99th percentile climate VaR is 16.9 per cent, or US$24.2 trillion. This is important, because low probability–high impact consequences are particularly important in some financial risk management regimes – insurance, for example.

A stress test that does not assess tail risks can be counterproductive by underplaying the risk to financial institutions of either higher climate damages or higher economic transition costs. This can also convey the wrong message: that firms are prepared to cope with climate-related risks when they are very probably not.

Incorporating uncertainty

Taking account of uncertainty is a fundamental challenge when estimating climate-related risks. The BES exercise explicitly aims to capture some of the policy uncertainties by exploring different levels of climate action in the proposed narratives. Nevertheless, other types of uncertainty should also be addressed. The estimates of physical and transition risks indeed strongly depend on many assumptions contained in models and on the type of model itself. Weaknesses have been found in several of the critical model assumptions that are highly influential in driving the energy pathways in the scenarios generated by integrated assessment models (IAMs; Pye et al., 2018). The limitations of IAMs can result in underestimations of physical risks, as well overestimations of the

cost of climate action and hence of the associated transition risks. In addition, energy system modellers do not tend to systematically explore extremes (McCollum et al., 2020).

Sensitivity analyses of the most relevant assumptions and types of models would be valuable for the BES exercise, as described below:

- **Uncertainty in estimating physical impacts.** There are significant uncertainties in the quantification of physical impacts as some physical processes – such as ice sheet dynamics and the triggering of severe storms and floods – are not well understood, while some linked hazards that could lead to substantial aggregate impacts – like sequential and concurrent extremes – are not well represented in models (DeFries et al., 2019).

  Because of these uncertainties, impacts are difficult to represent adequately in terms of costs and benefits, and are therefore often ignored or omitted from economic models – for example, many estimates do not account for the impacts resulting from the breach of climate thresholds. Even when the models do attempt to include such impacts, some modelling assumptions (i.e. impacts expressed solely in terms of effects on GDP, or models that only extrapolate from past experience or use inappropriate discounting) might lead to gross underestimates of economic consequences (Stern, 2016).

  Sensitivity analyses should be carried out on climate parameters to capture the scale of physical risks and across different dimensions, such as the speed at which physical impacts occur (gradual versus sudden change) as well as the magnitude of the impact.

- **Uncertainty in the evolution of socioeconomic pathways.** Population and economic growth are key determinants of the outputs of models. Assumptions about how socioeconomic pathways might evolve in the future have profound implications for changes in energy systems, land use and emissions. The development of the Shared Socioeconomic Pathways (SSPs) represents a serious effort to address this uncertainty, as these pathways encompass a wide range of long-term demographic and economic projections from the scenario literature (Riahi et al., 2017).

  Sensitivity analyses should be carried out on socioeconomic assumptions, at least for the basic elements of the SSPs in terms of alternative demographic and economic drivers. To help identify the key sensitivities to be included in each scenario, self-consistent narratives should be developed to underpin the assumptions on how socioeconomic trajectories will evolve in the future. However, even the SSPs do not capture the full range of plausible future socio-economic and political developments (McCollum et al., 2020). An exploration of extreme values could also be beneficial.

- **Uncertainty in the structure of the model.** Each IAM has a different structure, with some models being effective in capturing more details of the functioning of the economic system, while others represent technological detail but not macroeconomic dynamics. Variations in the features in the models can explain large differences between the results that they produce (Duan et al., 2019). The choice of the model often has a larger impact on the resulting emissions trajectory than the underlying SSP assumptions about future GDP, population and international policy cooperation (Rogelj et al., 2018; IIASA SSP Database). A multi-model comparison can be a useful way to understand some of the limitations of individual IAMs and to balance the strengths and weaknesses of each model. Nevertheless, there are some aspects of climate change mitigation that none of the currently available models can accurately capture, such as innovation dynamics and behavioural changes. A possible solution is to supplement the outputs of models with other tools and approaches (Gambhir et al., 2019), providing insights from other social–technical transitions or expert judgements. There is also a lack of assessment of real-world feasibility in many models even though it is obviously important to consider the social,

political, economic and technical barriers and drivers that can be associated with each mitigation pathway.

- **Uncertainty in transition pathways and mitigation options.** In assessing the proposed early policy and late policy scenarios, it is important to recognise that there is no single 'right' trajectory that can lead to the 'well below 2°C' target, but rather multiple pathways that can lead to the same levels of emissions reduction needed to reach the same climate goal. Each transition pathway can differ in terms of the details of the mitigation activities, with some pathways focused on supply-side decarbonisation strategies and others on demand-side options. Furthermore, different pathways can attribute a different role to some specific technologies, such as carbon capture, utilisation and storage (CCUS). There are several different pathways that are consistent with the same narrative, such as early policy action. An exploration of the range of pathways is crucial for understanding the different ways in which the zero-carbon transition could develop and the associated risks and opportunities.
- **Limitation in technological change/innovation.** Assumptions about technological development must be made for transition pathways and have implications for the assessment of the associated risks. Innovation is a path-dependent phenomenon and subject to inertia. It is initially difficult to shift technologies towards low-carbon options without policy interventions. In some cases, once a critical tipping point of deployment is reached, the reduction in technology costs can generate a positive feedback that can then lead to further acceleration of deployment of the technology. This, in turn, bolsters investments in supporting infrastructure and critical institutions (Zenghelis, 2019; Ekins, 2019). In addition, given the very long-term nature of these transitions, decisions made today may result in 'long shadows' that mean path dependencies become difficult or impossible to alter at a later stage (Aghion et al., 2014).

Unfortunately, most models fail to capture the effects of many innovation dynamics – such as knowledge spillovers, network effects, switching costs and feedbacks – and therefore underestimate the potential for technological change to drive the transition. The models also often overlook the dynamics of cost reduction for low-carbon technologies. This explains why models failed to predict the tenfold reduction in the cost of both solar photovoltaic generation and battery storage over the past 10 years (Bloomberg New Energy Finance, 2019). If the BES does not take account of such phenomena, firms might overlook key transition risks related to the emergence of disruptive innovations, rapid technological change and falling prices that can swiftly wipe out old high-carbon technologies.

Paris Agreement climate targets

The discussion document outlines how two of the proposed scenarios would be consistent with meeting the goal of the Paris Agreement of holding the rise in global mean surface temperature to well below 2°C. However, this is not a precise target. Some decision-makers have adopted the Paris Agreement's pledge of pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels, which would require a more rapid transition to net-zero global emissions.

Research indicates that there are substantial differences in the physical impacts that would occur at 1.5°C and 2°C increases in global temperature above the pre-industrial level. In a 1.5°C scenario, for instance, the magnitude of sea-level rise in 2100 would be reduced by about 30 per cent compared with a 2°C scenario (Schleussner et al., 2016). Limiting warming to 1.5°C could reduce the risk of crossing climate thresholds, such as destabilisation of the Greenland and Antarctic ice sheets and the associated large rises in global sea level (Dietz et al., 2018). The BES exercise should therefore explore scenarios with policy targets of limiting warming to both 'well below' 2°C and 1.5°C.

Geographical fragmentation of climate action

A scenario with geographical fragmentation of climate action could also be explored in the BES exercise. An underlying assumption of the scenarios outlined in the discussion paper appears to be that policy action across the globe is largely homogeneous. In the real world, however, climate action is highly fragmented. Some regions have set ambitious climate targets (e.g. the UK and EU have set long-term net-zero targets), while others are currently not intending to strengthen their shorter-term commitments (e.g. USA and Australia's Nationally Determined Contribution [NDC] targets).

The early and late action scenarios proposed in the discussion paper do not capture this fragmentation in climate policy, even though it is clearly already happening. The Bank could consider scenarios where the assumption of homogeneous climate policy is not fulfilled, and some countries or regions undertake ambitious climate action while others lag behind. Such scenarios would be qualitatively distinct because the geographical distribution of transition risks would be unequal.

Q5. Does the scenario specification adequately capture the risks in each scenario? Are there additional risk channels or scenario variables that should be considered as part of the BES?

While the physical and transition variables included in the BES discussion paper do identify some of the main climate-related risks for banks and insurers, it is also important to consider other types of risks that could have significant impacts – directly or indirectly – on assets and liabilities, as discussed below.

Supply-chain as a risk channel

Globalisation means that most businesses operate within extensive global production and supply-chain networks. Modern supply chains are characterised by specialised inputs that are more likely to be produced in specific locations which may be vulnerable to climate change impacts. As a result, businesses are exposed to climate change risks (both physical and transition) directly and indirectly due to their suppliers and customers. Barrot and Sauvagnat (2016) and Seetharam (2018) demonstrate that the impacts of extreme weather events can propagate through firm-level production networks. A PwC survey concluded that more than 50 per cent of chief executives mentioned risks posed to their global supply chains by climate change as one of their primary concerns (PwC, 2015).

Carbon border taxes (border carbon adjustments)

A climate policy landscape that is geographically fragmented means that some countries or regions could establish border carbon adjustment mechanisms to protect domestic industries against competition from countries where climate policy is weaker. The European Green Deal, for instance, proposes a carbon border tax as one of the measures necessary to achieve carbon neutrality by 2050. The imposition of border carbon adjustments could be considered in the scenarios for climate policy, as they could increase risks derived from the transition, especially through impacts on the supply chain.

Adequacy of carbon prices as a measure of policy strength

Many IAMs include carbon prices as outputs for mitigation pathways, reflecting the shadow price of meeting the specified emissions constraint. However, the carbon price, while related to the degree of mitigation effort, is not a clear proxy for policy strength or the potential degree of disruption or value at risk faced by different economic sectors and firms. For example, it is widely accepted that electric vehicles will reach cost parity with vehicles powered by internal combustion engines within the next few years, even without any carbon price. In many parts of the world, solar PV already outcompetes coal and gas electricity plants. In such a situation, the low- or zero-carbon price related to a transition from high- to low-carbon technologies would not reflect the

considerable potential disruption to the automotive sector. It is critical to consider the energy system and technological disruptions implied by different mitigation scenarios.

Assumptions about financial disruption

The addition of financial disruption to a transition scenario (as suggested in the late policy action scenario) introduces an additional layer of complexity to the BES exercise. IAMs do not include an explicit financial sector and though its addition is valuable, the interaction between the financial sector and transition behaviour is not well understood. Participating banks would benefit from a detailed explanation of the assumptions made to motivate financial disruption. They would also explore mechanisms through which financial losses might be amplified or avoided and the impact of disruption on transition financing. This includes assumptions made with regards to sovereign backstops, international capital flows and the financing of fiscal and current account positions.

Slow onset events and climate thresholds

Sudden shifts and shocks should be considered when assessing transition and physical risks. However, it is also important to consider both 'rapid onset' and 'slow onset' climate change events and their interplay in crossing climate thresholds. A rapid onset event is a single, discrete change that occurs within days or even hours, while slow onset events evolve gradually from incremental changes occurring over many years or from an increased frequency or intensity of recurring events (Siegele, 2012). There are some important relationships between rapid onset and slow onset events. Drought, for example, is an extreme weather event, but it is also a slow and incremental climatic change (IPCC, 2012). There is some indication that interactions between rapid onset and slow onset events may result in an ecological threshold or tipping point being crossed (Ross et al., 2009).

Litigation risks

Climate change litigation is increasing across the world (Setzer and Byrnes, 2019) and so is a relevant risk that should be incorporated more explicitly in the BES exercise. Litigation risks can relate to insurers facing legal action or their customers being exposed to liability claims. Both present a growing financial and reputational threat for which most insurers have not developed a strategy. The industry has not properly assessed litigation risks across different jurisdictions and lines of business, or what they mean for investment decisions.

Distributional impacts

Among the macro-economic variables for the scenarios, the Bank could include a wider set of metrics covering changes in wealth and income distributions, which are an additional component of transition risks. Both physical risks and the transition to a zero-carbon economy could negatively affect lower-income households to a greater degree, potentially exacerbating income and wealth inequality. This could have serious implications for regional consumption patterns and for public budgets at the local and regional level, and thus municipal bond markets, for example. The Bank of England needs to be able to monitor and understand both how prepared financial institutions are for these potential trends and to what extent the UK financial system fulfils its function of supporting the economy without exacerbating climate-related inequalities.

Q6. Are there alternative approaches to capturing the interactions between physical and transition risks, including capturing the impact of stranded assets?

Physical and transition risks are usually assessed separately, given the complexity involved in modelling and quantifying each case. In the context of the BES exercise, it is important to avoid investors focusing on 'transition risks' and insurers on 'physical risks', given that physical risks are also important for investments, while insurance decisions are also important for transition risks.

Moreover, it is important that the scenarios capture the trade-off between physical and transition risks. The impact of transition risks on businesses depends on companies' abilities to respond to new technologies, climate policies and regulations, and changes in consumer behaviour. As such, the interaction between physical and transition risks could be captured by the ability of certain industries to accommodate fundamental shifts in their business models. The impact of transition risks will depend on whether an industry shows underlying structural resilience.

Banks are unlikely to have established practices that enable them to identify potential stranded assets and some institutions may even lack a clear definition of the term. The concept of stranded assets may be relatively clear in some sectors, such as mining and power generation. However, it may be less clear where stranded assets in one sector could create a cascade across other economic sectors. Banks may face challenges in identifying stranded assets in the absence of a clear measurement framework. This may result in considerable variation between banks in their assessment of their exposures to stranded assets, driven more by differences in approach and definition rather than by different assessments of the economy. Banks would benefit from greater guidance in this area.

Q7. Are there particular external sources to calibrate physical and transition risk impacts that the Bank should consider when calibrating the scenario variables?

Insurance brokers may have analytical capabilities and data for a range of sectors and geographies. The Prudential Regulatory Authority should consider how to harness this in a way that does not infringe on confidentiality and competition.

Q10. Are there data gaps or modelling deficiencies that would impede participants' ability to model the scenarios? How would participants reflect judgements about companies' current mitigation and adaptation plans in their quantitative assessment?

While there is a general acceptance that risk disclosure is important, there is still little understanding of how climate risks can be assessed, and therefore reported, managed and, ultimately, reduced. At present, the analytical ability to assess current and future physical risks, as well as to assess opportunities, is generally limited: only a third of respondents to the June 2019 survey for the Task Force on Climate-related Financial Disclosures (TCFD) reported using climate-related scenarios for physical risk, with lack of data and tools identified as a barrier. While the demand for analytics for physical climate risk is increasing rapidly, largely in response to global initiatives such as the TCFD, the use of physical risk data and associated tools by investors and lenders remains very limited. Often, investment decisions proceed without any reflection on their exposure to physical risks (Surminski et al., 2016, 2020; Cambridge Institute for Sustainability Leadership, 2019). This is particularly concerning given global infrastructure needs, estimated to be up to US$90 trillion by 2030 (The Global Commission on the Economy and Climate, 2016).

Climate-economic models, such as IAMs, produce outputs that are often different from those required by macro-financial risk models or that are not at the resolution required. As an example, most modelling approaches lack sectoral granularity. Many integrated assessment and energy system models cannot identify the technological transitions associated with low-carbon pathways at the level of individual business or industrial sectors (and certainly not at the level of individual firms). For instance, many models can include the high-level transitions that might take place in the iron and steel sector (e.g. from coking coal blast furnace to electric arc furnace steel production). However, individual firms produce different grades of steel using different processes, so their ability to transition as part of a low-carbon pathway is not well captured by these models. It follows that extensive additional ('off-model') analysis is likely to be necessary to determine the ability of individual firms and sub-sectors to make a successful zero-carbon transition. In addition, it is unlikely that individual firms' strategies adequately capture their long-term transition plans in enough detail.

There is currently no common method for firms to assess adaptation or resilience efforts by their counterparties. Nevertheless, there is a growing set of information sources that can inform assessments, including self-reported adaptation efforts through the Carbon Disclosure Project, the adoption of ISO climate adaptation standards, or by considering a range of resilience metrics. The forthcoming Third UK Climate Change Risk Assessment will provide an update on corporate adaptation efforts in the UK.

Q11. Would participants be able to assess 80 per cent of their corporate counterparties at counterparty level, leveraging the tools set out in Annex 2 and expert judgement?

The exercise requires banks to make significant judgements about the strategies of their counterparties when performing financial risk assessments. The discussion paper encourages banks to utilise climate disclosures and engage directly with their customers to inform these judgements, with the aim of covering 80 per cent of nominal exposure to corporates in this manner. While an understanding of corporate strategy is invaluable in assessing the financial risk of a counterparty, banks are likely to face significant challenges in doing so, given the very different levels of understanding of climate risks and opportunities across countries, sectors and firms. This affects both the current quality of the climate disclosures of corporates and also their willingness and ability to engage with banks on the three specific scenarios outlined in the discussion paper. Participating banks may find themselves in a position where they must devote a large amount of time educating their customers on the requirements of the BES exercise and may obtain information of limited value as a result. A more tightly specified exercise may be of greater benefit, giving banks the time to interact more intensively in the first instance, with a limited number of large corporate exposures in the most sensitive sectors.

Q15. Would the proposed outputs accurately capture the climate-related financial risks faced by participants and achieve the objectives of the BES?

An accurate assessment of climate-related risks, especially in the medium to long term, is nearly impossible due to the deep uncertainties around climate change as well as the socio-political reactions to it (see e.g. Chenet et al., 2019). The Bank of England should thus consider that the value of the BES exercise is not as an accurate assessment of risk and preparedness, but instead as an exercise to build organisational capacity.

It is also relevant to understand which conclusions firms can draw from the BES exercise, and how it could influence their own strategies.

In this respect, it is important that firms disclose how they arrive at the results. In the past, while assessing current physical risks with catastrophe models, many firms outsourced the analysis or used 'black box' models to obtain an input for their own stress tests, without understanding the limitations and uncertainties of those tools. It would be, therefore, very useful to support firms in producing their own estimates, interpreting findings and drawing conclusions from the BES exercise.

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