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Let's talk about the weather: the impact of climate change on central banks

Misa Tanaka (with Sandra Batten and Rhiannon Sowerbutts)

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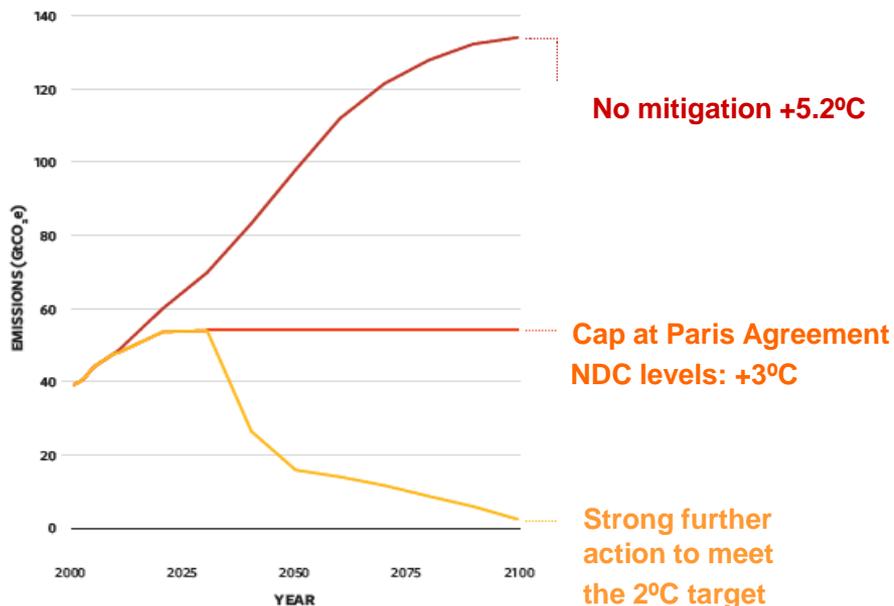
DISCLAIMER: The views expressed in this presentation are those of the authors and not necessarily those of the Bank of England, the MPC, the FPC or the PRA Board.

Outline of the Paper

- The paper examines the channels via which climate change and policies to mitigate climate change could affect central banks' ability to meet their two main objectives.
- **Financial stability:** removing and reducing risks and weaknesses in the financial system, and promoting safety and soundness of individual financial institutions (DNB (2016), ESRB (2016), Bowen & Dietz (2016)).
- **Monetary stability:** delivering stable prices and confidence in the currency.



GHG emissions & climate change



Source: AVOID 2.



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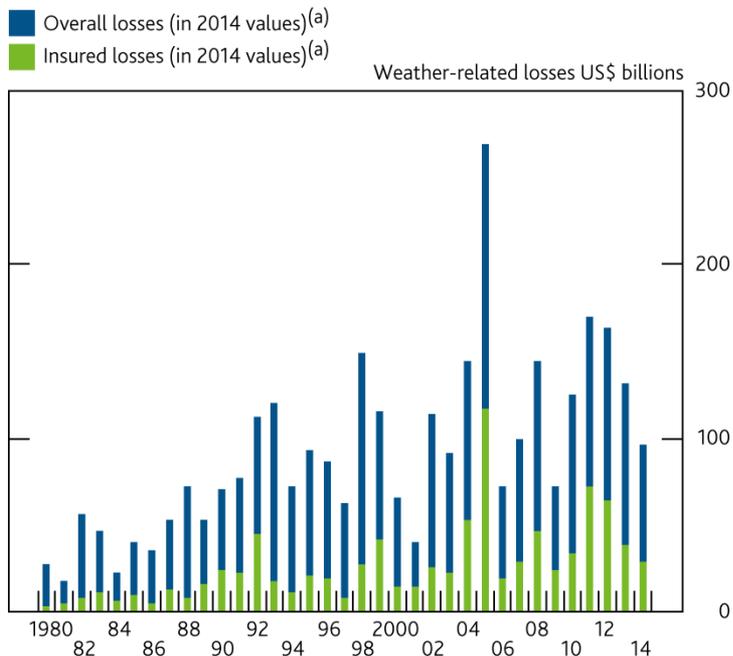
- Warming above 2 °C relative to pre-industrial period could lead to potentially catastrophic consequences (IPCC 2014).
- GHG emissions were the primary cause of the observed warming, with CO₂ being the most important source (IPCC 2014).
- The 2015 Paris Agreement targets warming 'well below 2 °C', but country pledges (NDCs) are not enough.

Three types of climate-related risks

- **Physical risks:** risks that arise from the interaction of climate-related hazards with the vulnerability of exposure of human and natural systems.
- **Transition risks:** risks of economic dislocation and financial losses associated with a disorderly transition to a lower-carbon economy.
- **Liability risks:** risks that liability insurance providers end up with large claims related to loss and damage arising from physical or transition risk from climate change.



Physical risks & impact on financial stability



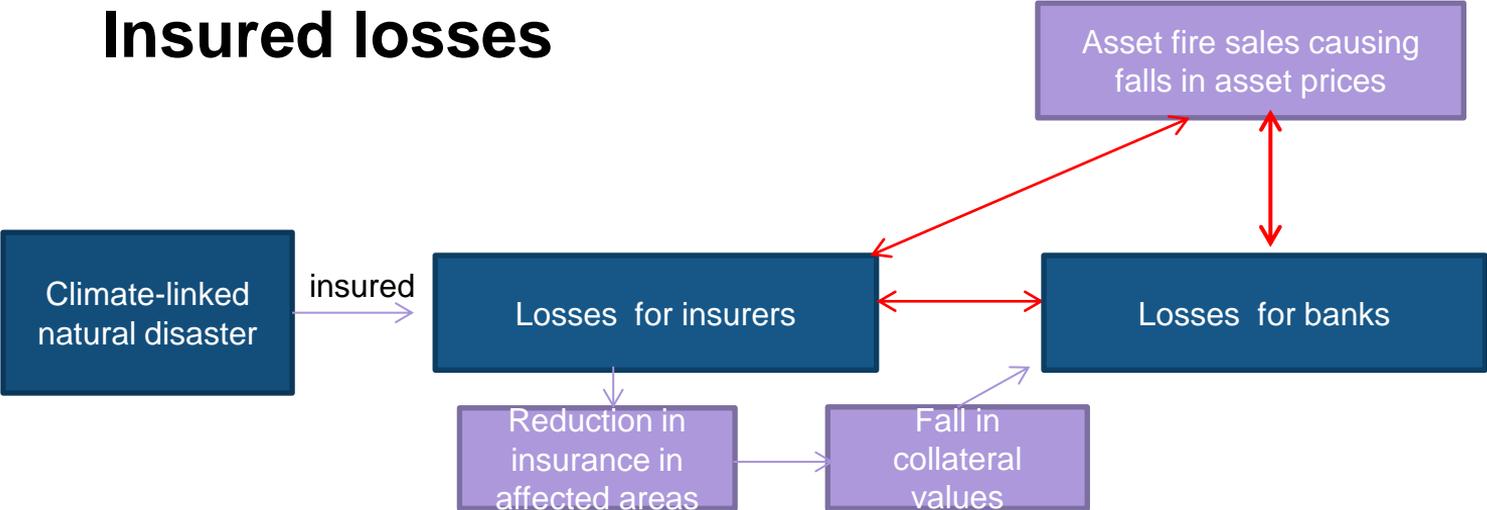
- Climate change could increase the frequency, magnitude and correlation of weather-related perils.
- Overall losses from weather-related loss events worldwide has been increasing since the 1980s.

Source: PRA (2015), based on Munich Re NatCat SERVICE data.

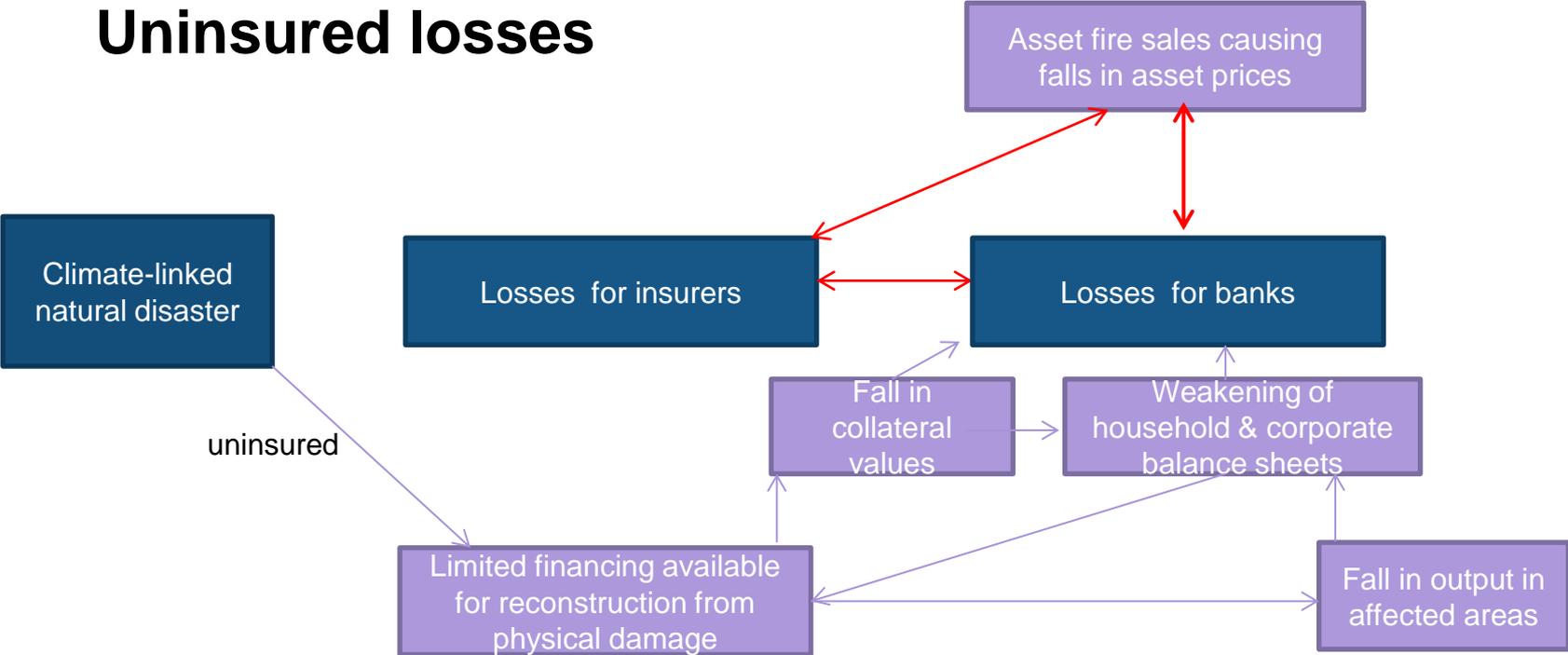


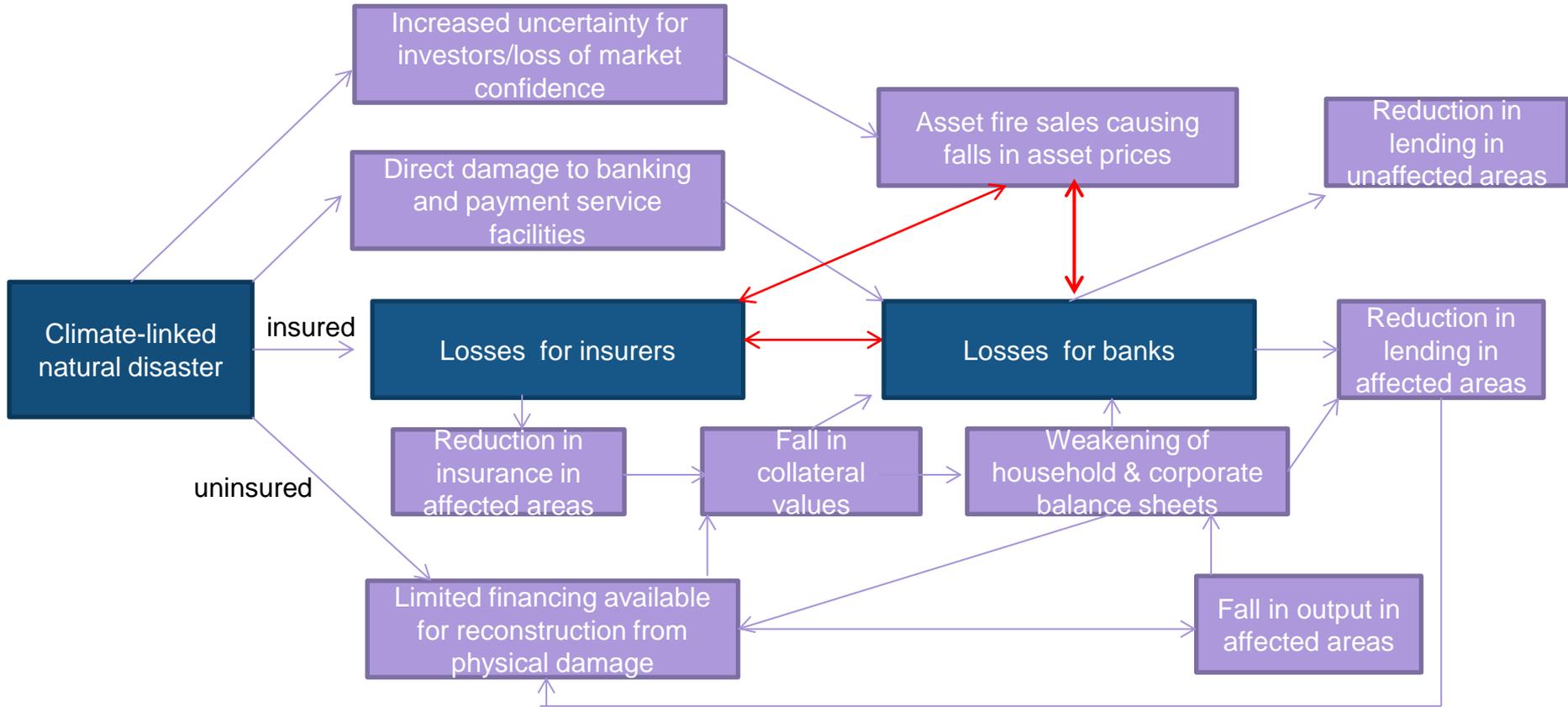
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Insured losses



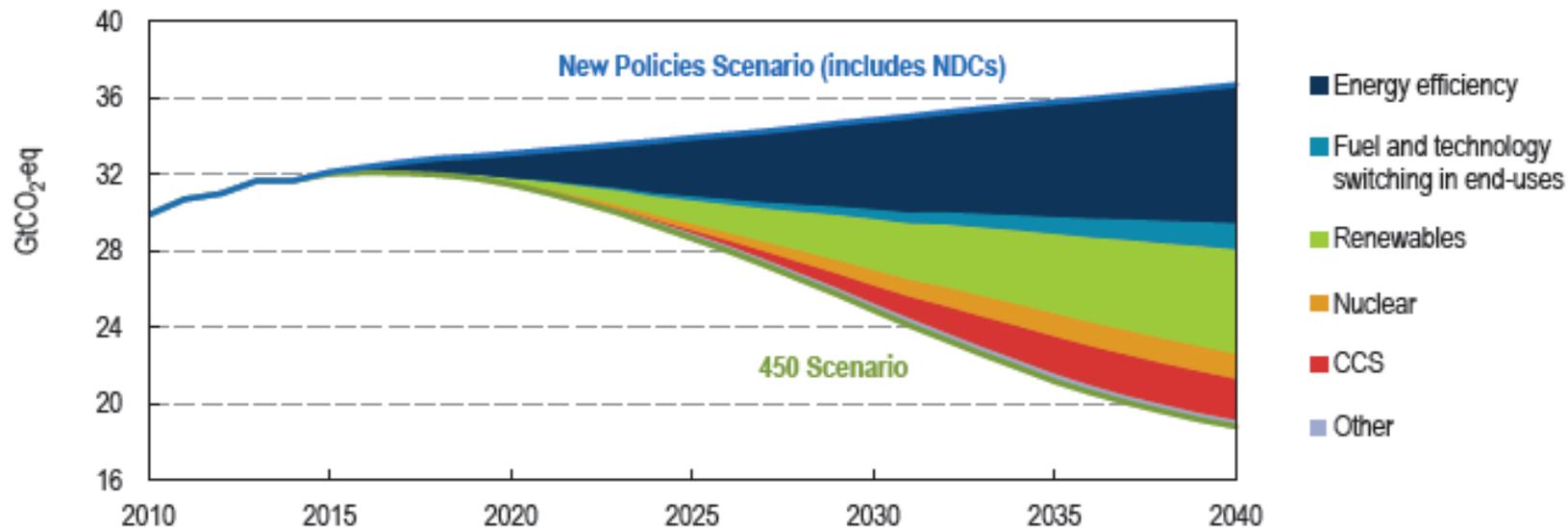
Uninsured losses





Transition risks: The gap between Paris & 2 Degrees

Measures needed to surpass current NDCs to reach 2°C trajectory (450 Scenario), through 2040



Source: IEA (2016).



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Carbon budget and the risk of asset stranding

- ‘Carbon budget’: no more than 1000 GtCO₂ can be further emitted to limit warming to 2 °C. (around 1900 GtCO₂ already emitted)
- McGlade and Etkins (2015): 35% of global oil, 52% of gas and 88% of coal reserves will be ‘unburnable’ before 2050 without CCS in order to achieve the 2°C target.
- Pfeiffer et al. (2016) : No new CO₂ emitting electricity infrastructure can be built after 2017 unless other electricity infrastructure is retired early or retrofitted with CCS technologies.



Example: investing in CCS

Government

Electricity
companies

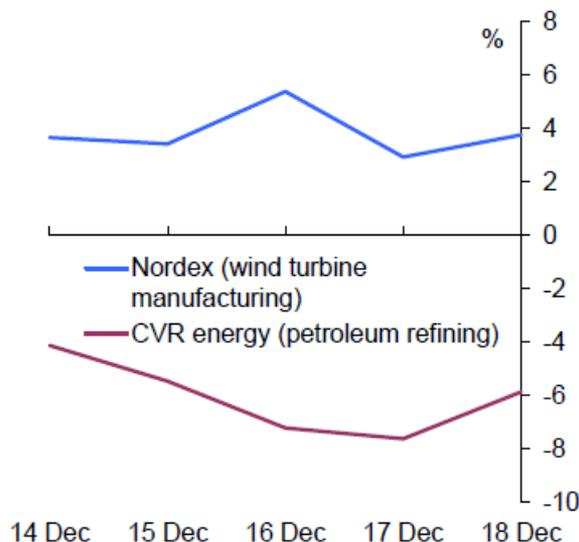
	Shut down unabated power plants in future ('time T+1')	Keep open unabated power plants in future ('time T+1')
Invest in CCS now ('Time T')	<p>Orderly transition: Low carbon equilibrium</p> <p>EC: profit G: low cost of shut down</p>	<p>EC: loss G: suffer some adverse impact of climate change</p>
Don't invest in CCS now ('Time T')	<p>Disorderly transition: Stranding of unabated power plants</p> <p>EC: loss G: high cost of shut down</p>	<p>No transition: High carbon equilibrium</p> <p>EC: profit G: suffer adverse impact of climate change</p>



BAI

Asset price reaction to 'carbon' news

Cumulative abnormal returns after the Paris Agreement, December 2015



- Event study suggests specific companies saw abnormal returns after Paris Agreement.
- But news stories about 'carbon bubble', 'unburnable carbon' etc. did not have statistically significant impact on the abnormal returns for oil & gas companies during Jan 2011-Jan 2016.



Risk assessment: Physical risks

- Quantitative assessment of the impact of physical climate risk on the financial system isn't very meaningful.
- In principle, climate science could inform construction of weather-related stress scenarios, but there is scientific uncertainty over the quantitative impact of climate change on the frequency/magnitude/correlation of weather-related perils.



Risk assessment: Transition risks

- Risk assessment scenarios could be constructed around
 - Increases in carbon prices affecting all sectors; or
 - Shocks to specific sectors (e.g. Battiston et al. 2016).
- But there are gaps in the regulatory data



Risk mitigation: physical risks & market failures

- **Externalities:** financial institutions may not take into account the impact of financing investments that are intensive in CO₂ emissions on climate-related physical risks.
- **Mispricing of risks:** Insurers and banks may not be pricing in the risks of certain perils accurately, because of i) asymmetric information and ii) uncertain impact of climate change on specific perils.
- **Incomplete markets:** Fundamental uncertainties about potential losses could lead to missing markets, e.g. insurance for high flood/hurricane risk areas



Risk mitigation: role for prudential regulators?

- Prudential regulations are too ‘blunt’ to deal with externalities.
 - Relaxing regulations to encourage ‘green’ lending could be inconsistent with the objectives of prudential regulations.
 - Tightening regulations on high-carbon sectors could have unintended consequences, e.g. increasing the cost for these firms in investing in carbon-reducing technologies.
- But prudential regulators could promote resilience to climate change and support an orderly transition by removing market frictions



Risk mitigation: climate-related disclosure

- FSB Taskforce on climate-related financial disclosures (TCFD): to develop voluntary, consistent climate-related financial risk disclosures: aimed at removing asymmetric information.
- Could contribute to orderly transition if it manages to influence the investment decisions of a wide range of investors.
- The information presented to investors need to be simple, forward looking, and relevant. But it also needs to be verifiable.



‘Simple & relevant’



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Per 100g	half a pack as prepared provides	Energy	Fat	Saturates	Sugars	Salt
728kJ	1274kJ	18.1g	8.2g	10.2g	1.09g	
174kcal	305kcal					
		15%	26%	41%	11%	18%

MEDIUM

USE BY

'Verifiable'

Nutrition

Allergen Information

May Contain Nuts, May Contain Peanuts, May Contain Sesame Seeds

Ingredients

Diced Chicken Breast (36%), Half Cream (**Milk**), Onion, Tomato, Yogurt (**Milk**), Tomato Purée, Rapeseed Oil, Garlic Purée, Ginger Purée, Low Fat Yogurt (**Milk**), Chopped Coriander, Butter (**Milk**), **Cashew Nut**, Paprika, Potato Starch, Salt, Sugar, Ground Coriander, Ground Cumin, Lemon Juice, Chilli Powder, Turmeric, Fenugreek, Cinnamon, Ground Ginger, Black Pepper, Clove, Ground Bay Leaf, Lemon Oil, Colour Paprika Extract, Nutmeg, Cardamom, May also contain other Nuts, Peanuts and Sesame

Dietary Information

Contains Milk

May Contain Nuts

Contains Cashew Nuts

May Contain Peanuts

May Contain Sesame Seeds

Nutritional Data

Typical Values	As Prepared Per 100g	As Prepared Per 1/2 Pack
Energy kJ	728	1274
Energy kcal	174	305
Fat	10.3g	18.1g
of which saturates	4.7g	8.2g
Carbohydrate	7.0g	12.3g
of which sugars	5.8g	10.2g
Fibre	1.1g	2.0g
Protein	12.8g	22.4g
Salt	0.63g	1.09g



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Simple, forward-looking disclosure: an example

- Projected profit under a baseline (e.g. NDCs) vs a tighter climate policy scenario (e.g. a higher carbon price) under specified time horizon (e.g. 5 years), given assets & announced future investment plans
- Key assumptions used to make the projection (ideally standardised for comparability)
- % of profit at risk could be mapped into ‘traffic lights’



Impact on monetary policy

- **Physical risk:** more volatile food prices, changes in seasonal pattern in inflation rates, impact on potential growth.
- **Transition risk:** increased reliance on bioenergy could increase the volatility of headline inflation rates, as both food and energy prices could react to the same weather-related shocks.
- Near-term impact is difficult to quantify, but could make it more challenging to gauge underlying inflationary pressures.



Conclusions

- First step towards understanding the impact of climate change on central banks' objectives. Potential further work: quantifying prudential risks arising from disorderly transition; and incorporating climate science in risk assessment.
- Role for prudential regulators in maintaining resilience of financial system to climate-related risks; and removing market frictions to support an orderly transition to a lower-carbon economy.

