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An innovative approach to climate transition risk for scenario modelling

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Modelling Climate Transition Risk

- The need for scenario analysis to quantify the impact of climate change on banks' business models is becoming more acute. The recent Consultation Paper on Climate Risk (CP 10/25) makes this very clear.
- CBES was a good start, but the next phase of stress testing requires banks to take more ownership of scenario design. And given governments are reluctant to pull the levers that might mitigate the risks, understanding the connections between those policy levers and the economy is vital given delays will mean more action, but later.
- 4most has built a detailed economic model with roots in economic theory. It is clear about the transmission mechanisms that link climate to the economy – vital for stakeholder confidence. And it allows narratives to be built and tested.

Key model features

- The model allows users to flex the carbon price along with assumptions of how much foresight firms have about policy changes. The price of different energy sources is determined in the model but can be varied by users, as can the energy mix. The model answers questions around sensitivities to changes in technology.
- Output for 59 different industrial sectors are covered. As well as GVA, the model provides consistent paths for employment, investment, real wages and a proxy for the cost of capital.
- This allows macroeconomic aggregates such as GDP and unemployment to be calculated. There are winners as well as losers as the economy adjusts.

Why do we need transition risk scenarios?

The recently issued Consultation Paper on Climate Risk (CP 10/25) takes a large step forward in guiding organisations on their expectation – at the heart of this is the need to ensure Climate Risk Scenarios Analysis (CSA) and Climate models are embedded throughout.

How should businesses be using scenarios to think about risk?

- To understand the impacts of climate change over different time horizons

- To identify risks, including:
  - ✓ Policy and legal risks (e.g., new regulations, carbon pricing)
  - ✓ Technological risks (e.g., advancements in green technology that will leave stranded assets),
  - ✓ Market risks (e.g., shifts in supply and demand), and reputational risks (e.g., changing public perception).

- Strategic planning
  - ✓ Ensure that the firm's overall strategy is coherent with any climate targets the firm has adopted. This means integrating climate considerations into the core business strategy
  - ✓ Set and own the overall business risk appetite for climate-related risks. This includes establishing climate-specific risk appetite statements for any material climate-related risk

- Regulatory compliance

- Decision making – there are opportunities as well
  - ✓ Scenarios provide decision-useful information that can guide the board and management in making informed choices about risk appetite, capital allocation, and other strategic decisions

How should we think about the economics of climate transition?

A macroeconomic model can help the business think about issues by providing a coherent framework

- The model is built around a supply-side view of the economy, rather than being driven by demand. What will the future structure of the economy look like? And how will we get there?

- Productive potential is determined by the amount of capital (defined as machines, plant etc), labour and how well these are combined (ie productivity and efficiency)

- The capital mix changes across sectors in response to the cost of doing business. A carbon tax puts the cost of polluting onto the polluter and raises their cost of capital. Sectors that are reliant on fossil fuels (or 'flame reliant' as shorthand in what follows) will see that cost of capital rise most.

- If we plan, then both types of capital can be gradually reallocated between sectors and technical advances will reduce the reliance on flames. If we do not, and action is forced on us, then the scope for disruption is huge.

- There will be winners, as well as losers. As demand for labour falls in the sectors most affected, workers will move to other areas, but possibly at the cost of lower wages. It will take a long time, but eventually the economy will return to equilibrium.

Model Overview - energy

Economic Theory

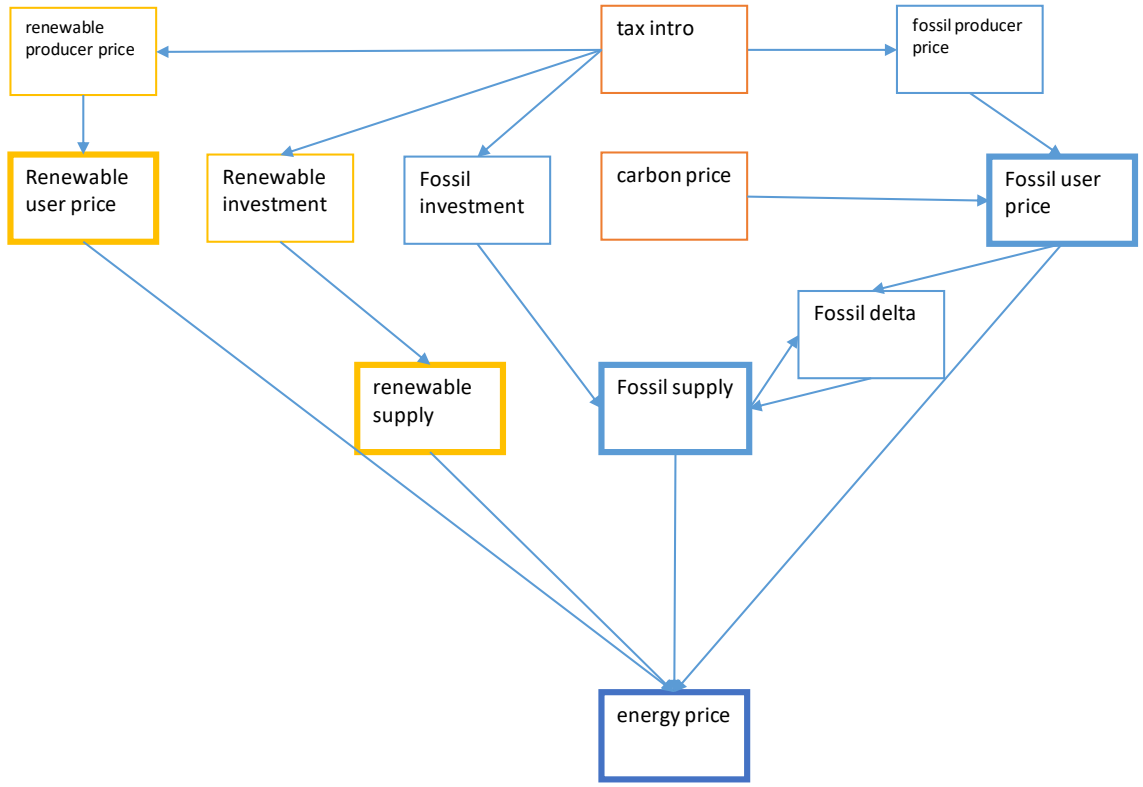
The carbon price is the key lever

A high carbon price will obviously increase the cost and reduce demand for energy from fossil sources

Investment in renewables through a favourable tax regime can increase supply of renewable energy

The overall energy price is a blend of fossil and renewables

Energy Model



The Energy Price Module consists of fossil fuel and renewable costs and supply, driven by carbon tax price and technological improvements

Model Overview – economic linkages

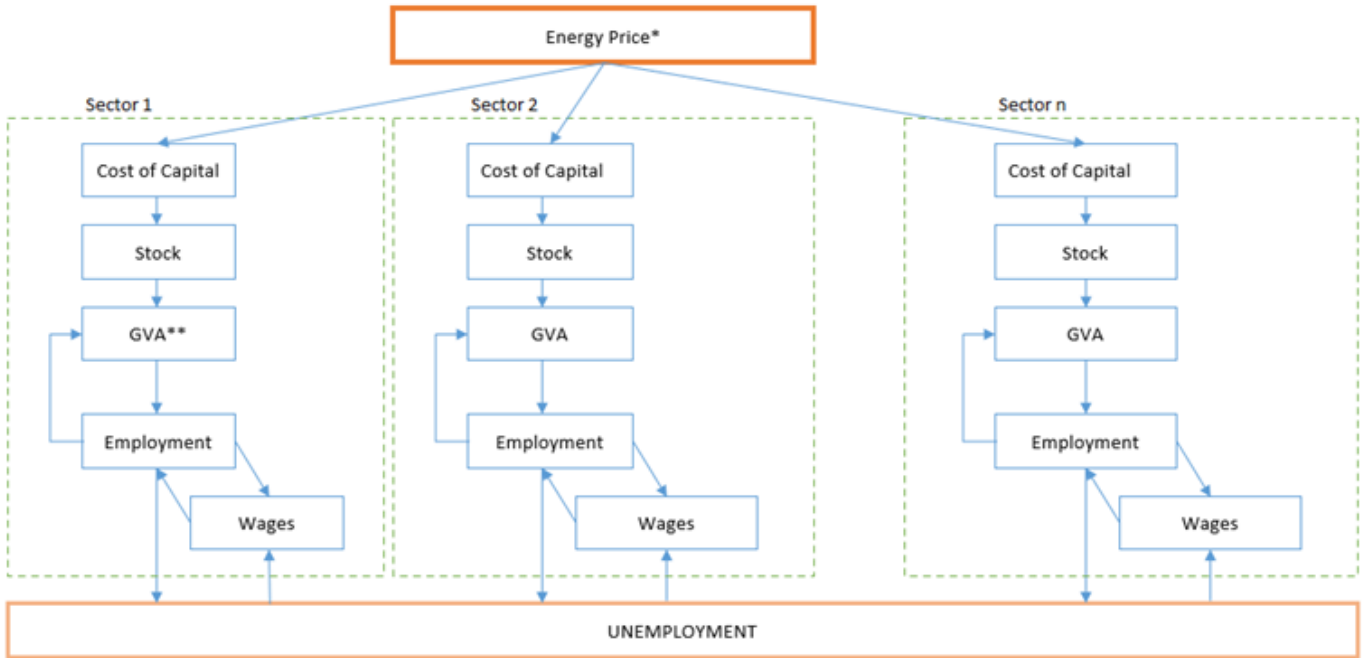
Economic Theory

Higher energy costs leads to reduced investment

Without investment, business will shrink:

With higher Capital costs, businesses will find they have too much capital stock

Reduced sector employment, and higher national unemployment causes salaries to fall



- ✓ The foundation of the model is economics not Climate
- ✓ Forecasts of GVA for 59 difference sectors
- ✓ Matching employment projections to aid understanding of risk of lending to different groups.
- ✓ Underlying measures of investment demand and cost of capital.

Climate Transition Scenarios – the levers

Government can manage and limit climate change impact through policy and a drive to more sustainable energy sources. 4most have incorporated core levers that the government can pull.

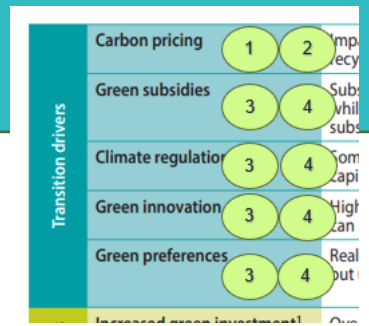
What are the levers?

Carbon tax – The number 1 impact government can introduce to limit emissions.

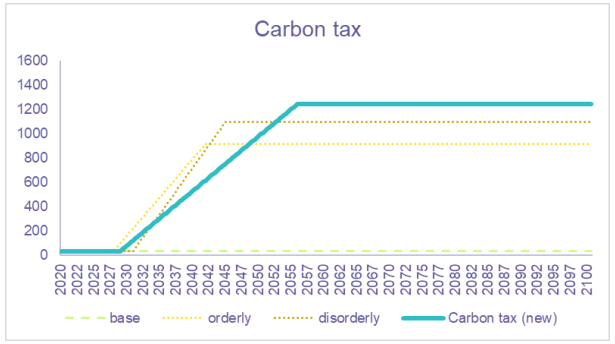
Foresight

Fossil dependency

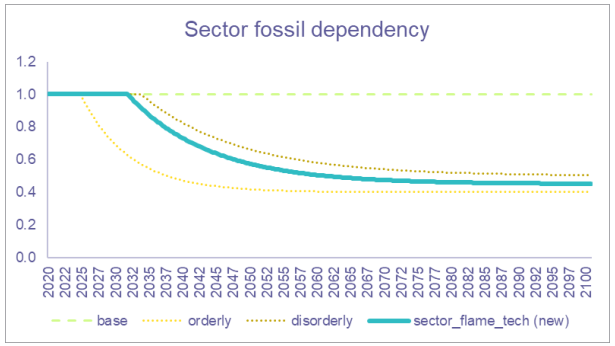
Renewable Technology



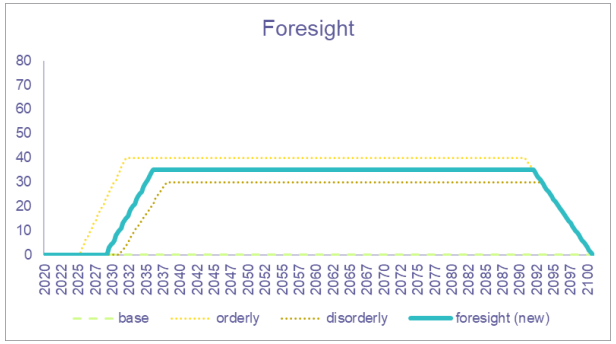
Aligns with NGFS thinking - **The green transition and the macroeconomy** – *Table1: Potential transitional impacts on inflation and output over the monetary policy horizon*



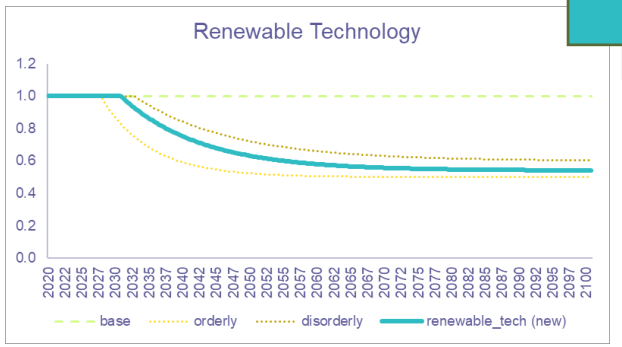
Charging for carbon emissions makes fossil fuels less viable



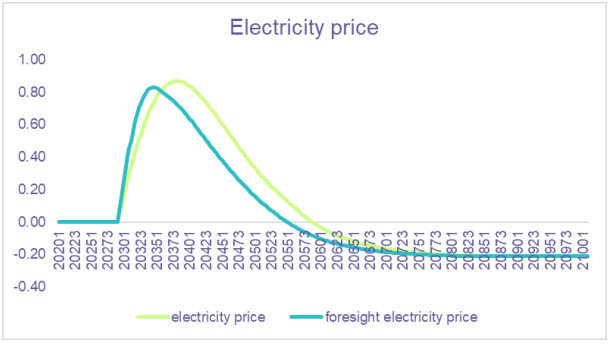
Industry fossil dependence can be reduced through R&D projects and grants, tax breaks

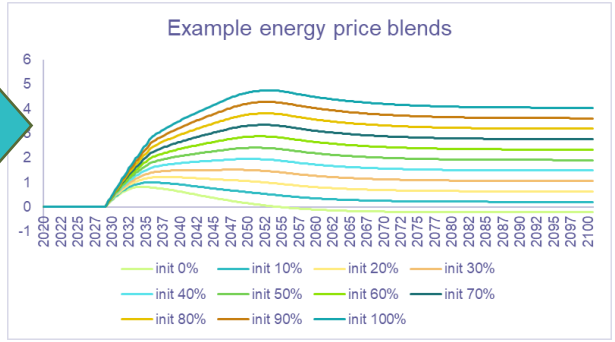


The Government can give advance warning of changes allowing industry to make changes to prepare for cost changes



Likewise renewable technology is expected to improve over time, again government grants, tax breaks and planning policy (onshore windfarms) will drive this





Any carbon tax introduction will have an impact on electricity prices - but this will improve over time due to actions taken which the government can drive

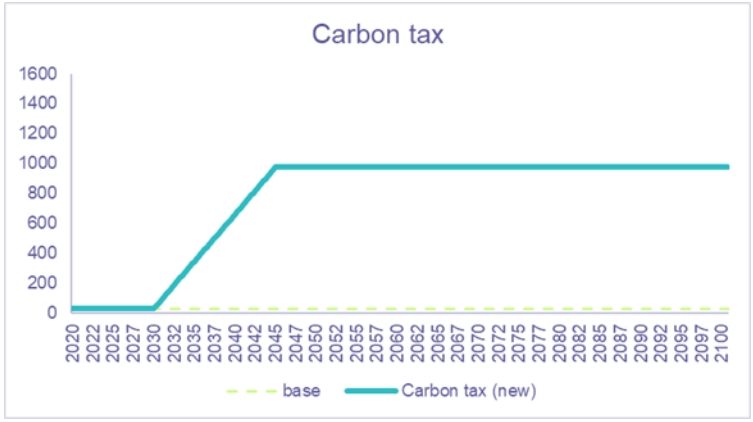
A use case: the impact of greater energy efficiency in aviation

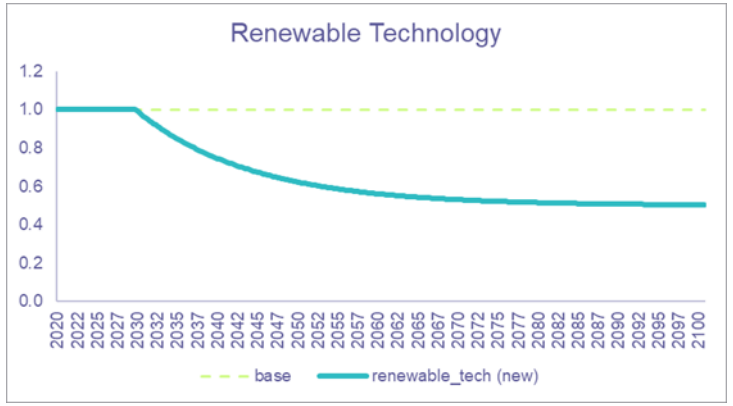
Key starting assumptions across all sectors

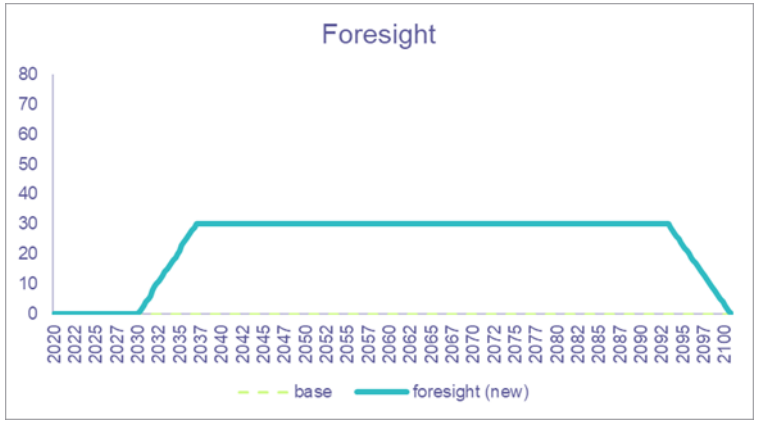
A base scenario that assumes no transitional climate impacts is built.

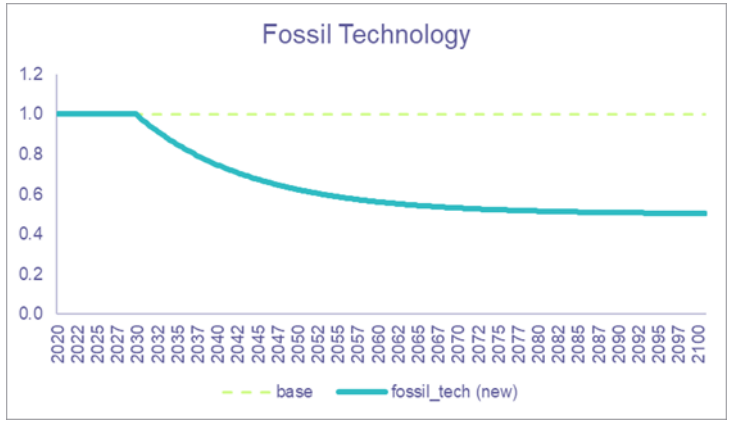
Then the core assumptions are used to model the impact of the following changes

- **Carbon tax** – steep rise to peak around £1000
- **Foresight** – Slow initial foresight before tax introduction, but building fairly quickly
- **Technology** – Reasonable improvements in energy technology, counteracting the carbon tax to some extent







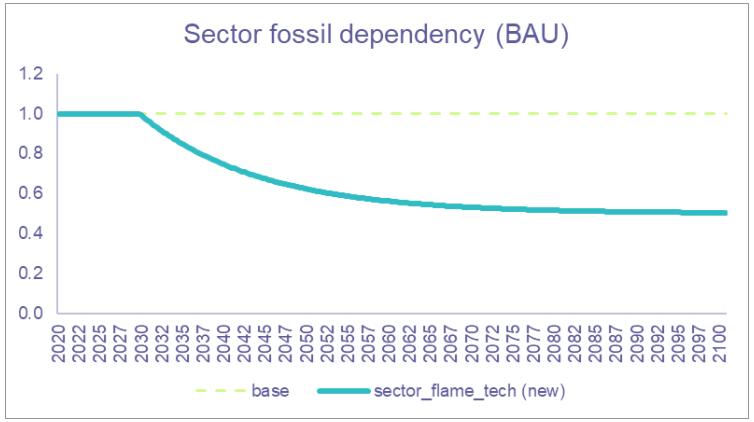


Sector specific sensitivity: adjusting the fossil dependency

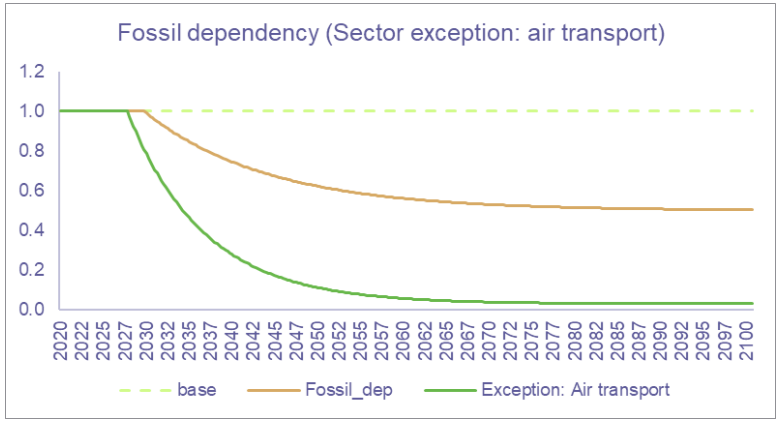
At face value, the aviation sector will be a big loser when carbon taxes are introduced. The model allows us to pull various levers to see how this might change.

- In the Climate Ambition scenario, we examine a decoupling of aviation. This reflects the increased use of Sustainable Aviation Fuels (SAF). Examples include using cooking oil and other energy sources, operational improvements and fleet upgrades
- Common Ambition - ambitious fossil dependency improvements for all sectors. Given the interactions of the model with all sectors the common ambition shows a similar improvement across all industries as that shown for the airport transport sector to show how the industry is impacted as other sectors also make a similar push to go green.

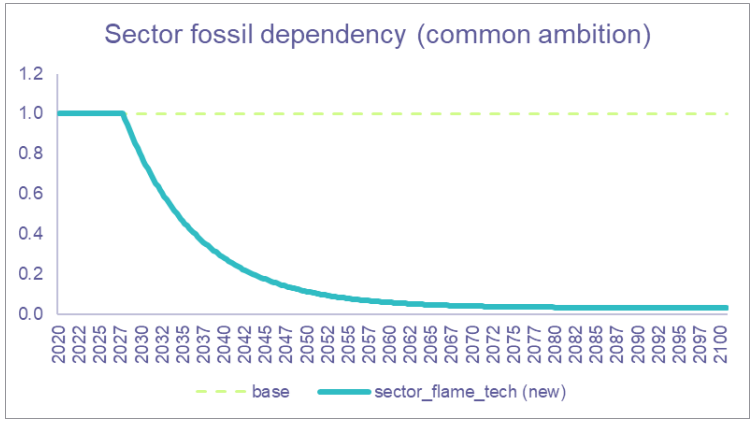
BAU



Climate ambition (air transport exception)



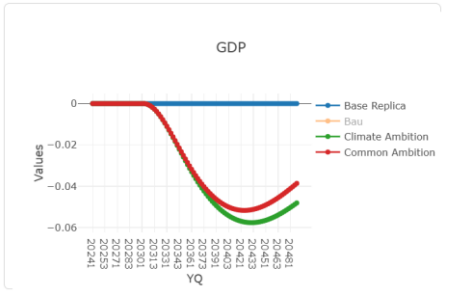
Common ambition

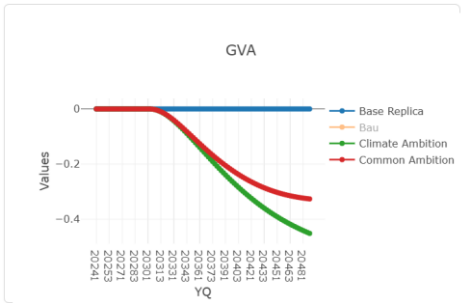


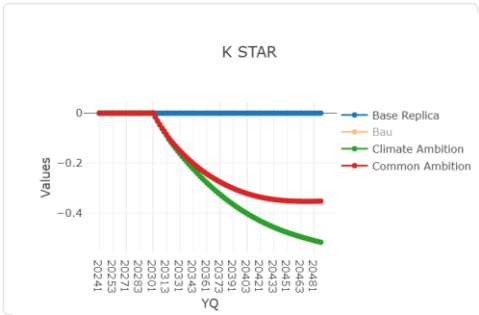
Scenario results: extractive industries

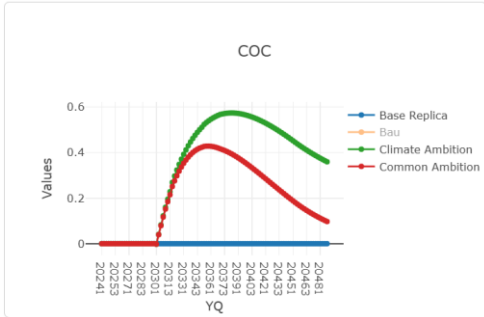
UK

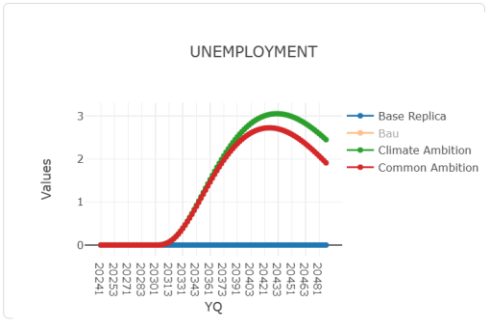
Sector: Mining crude petroleum, natural gas, metal ores

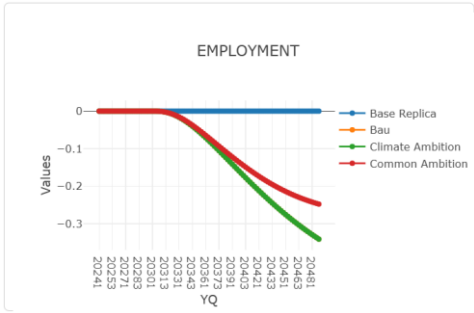


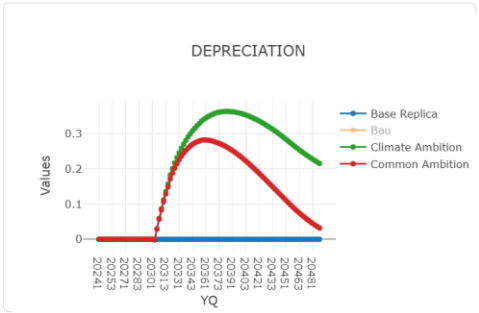


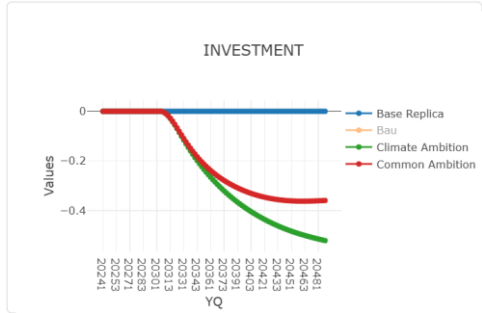


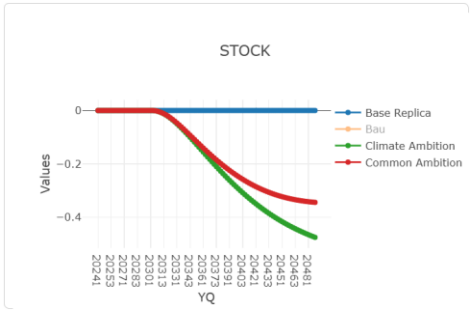


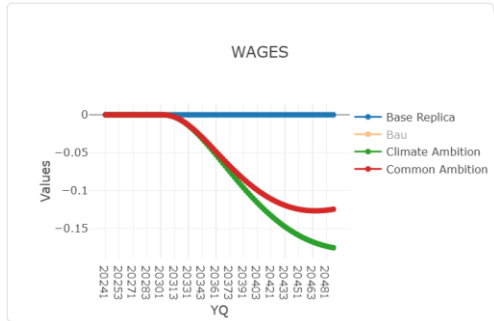












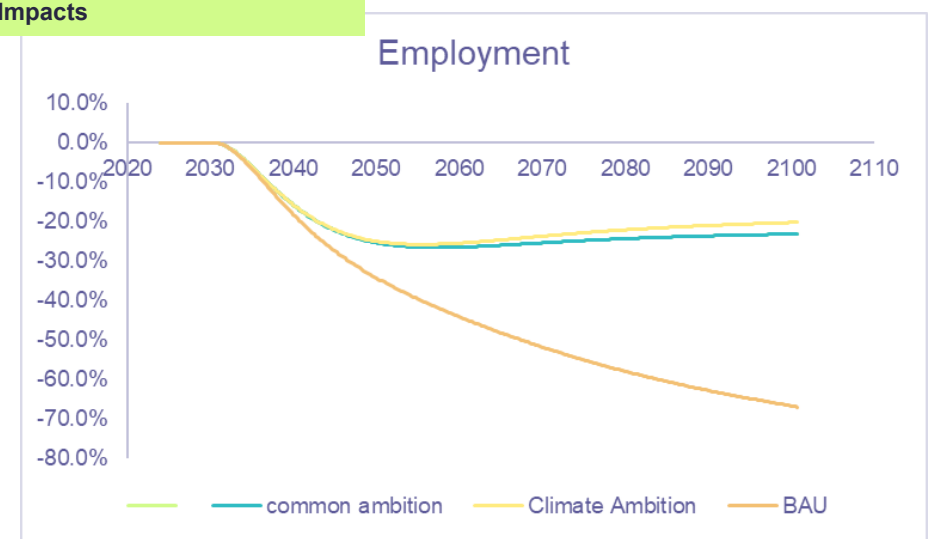
The charts shows a range of model output based at UK and Sectoral level showing the Climate Scenario vs a Core Scenario.

The model outputs absolute value and relative values (Core vs Climate) that allows for overlays to be added into incumbent models (if the information is already included within the existing models).

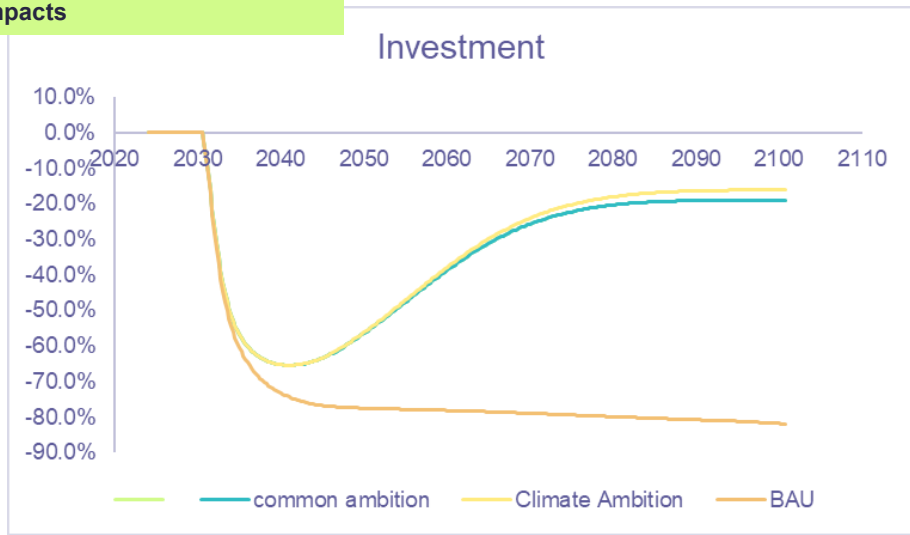
Scenario results: air transport

- A BAU scenario with a high carbon price and improvement in technology is devastating.
- But a big reduction in fossil dependency obviously limits the damage. The sector still grows in this scenario but would be much smaller still in the long run.
- If all sectors get their act together in a similar way, then aviation is worse off.

Relative Impacts



Relative Impacts



Concluding thoughts

- The Consultation Paper on Climate Risk (CP 10/25) by the Prudential Regulation Authority (PRA) is vital for banks as it outlines updated supervisory expectations for managing climate-related risks
- From a governance perspective, climate is a Board level issue. Senior Management needs to provide the board with specific, decision-useful information and appropriate training on climate-related risks. This model helps because it is structural and spells out how the economics of climate transition works.
- The results are a reminder (that many have forgotten since the 1980s) that big structural changes to the economy can have large impacts that run for decades. But there are relative winners as well as users and this framework can help not only with the risks but where bank capital should be redeployed.
- This is an area where the world changes quickly. The framework of the model is, as far as these thing are possible, future-proof. It can cope with new technologies which change the fuel intensity of the production process.
- Crucially, a structural model allows the user to take ownership of the scenarios and ask 'what if' analysis around key sectors.

Thank you.

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