Economic policy – including monetary policy – and climate change

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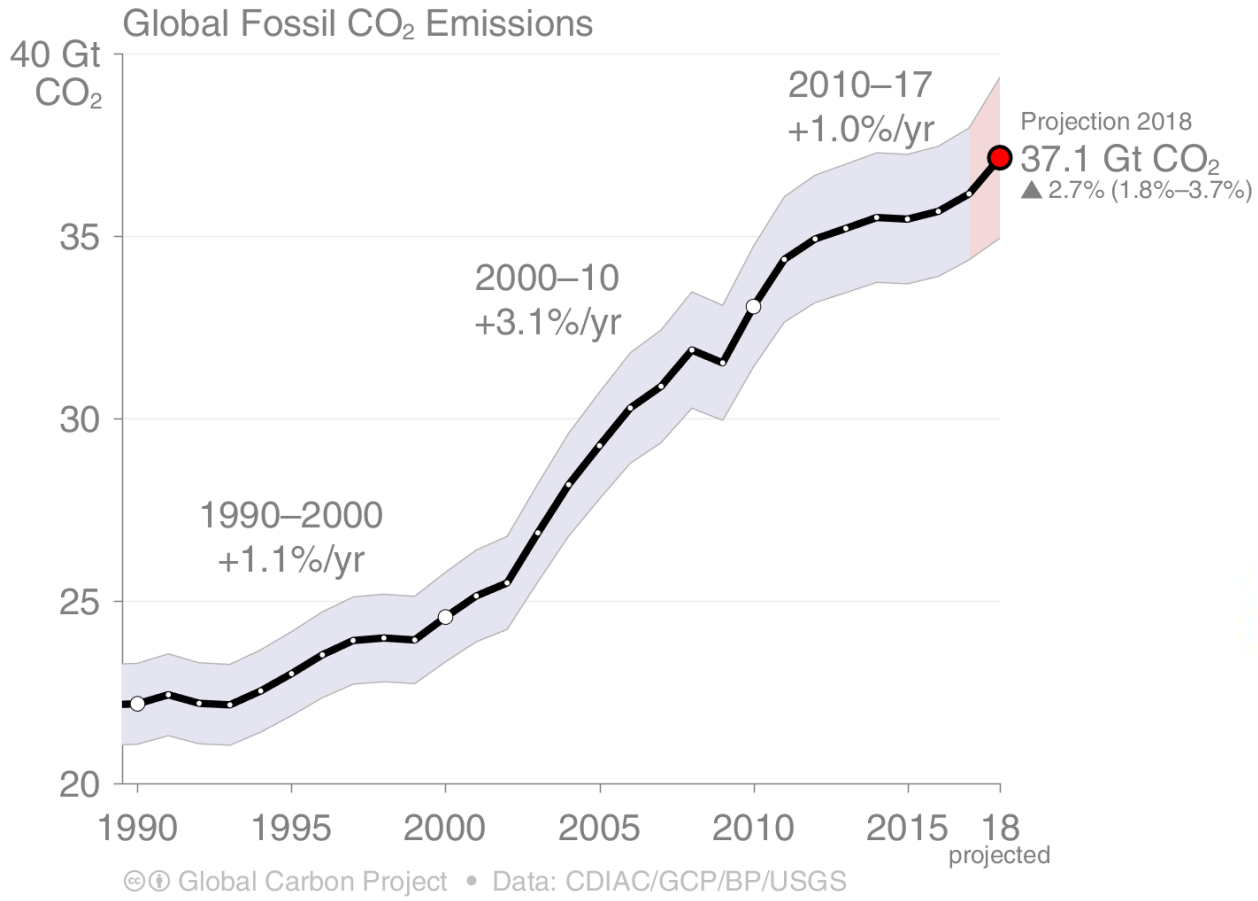
Global fossil CO_2 emissions: 36.2 ± 2 $GtCO_2$ in 2017, 63% over 1990

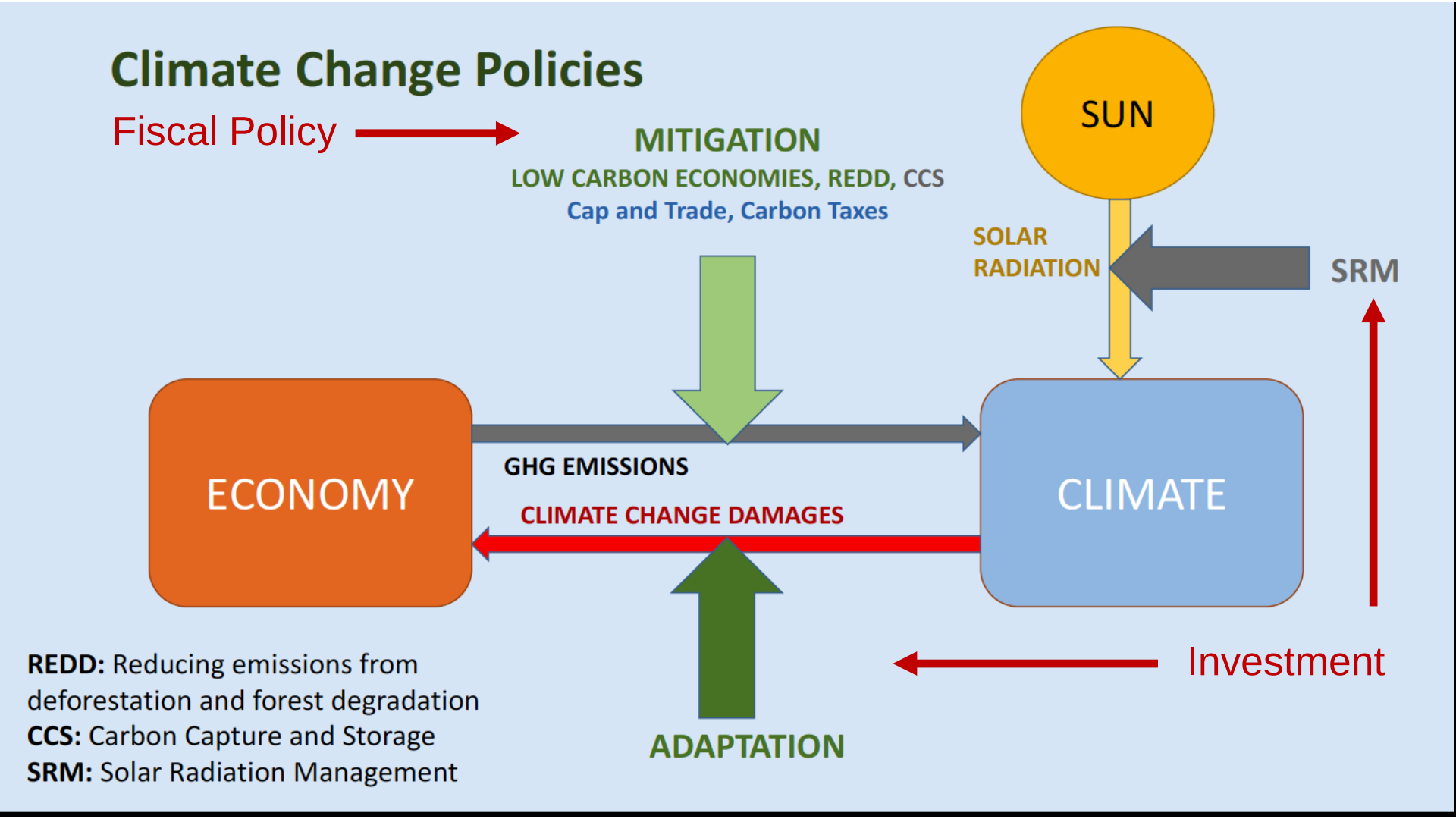
Projection for 2018: 37.1 ± 2 $GtCO_2$, 2.7% higher than 2017 (range 1.8% to 3.7%)



Uncertainty is ±5% for one standard deviation (IPCC "likely" range)

Estimates for 2015, 2016 and 2017 are preliminary; 2018 is a projection based on partial data.

Source: CDIAC; Le Quéré et al 2018; Global Carbon Budget 2018



Monetary Policy – Central Banks-Financial System ?

Project Output

- Book: The Economics of Climate Change
- WP: Monetary Policy under Climate Change
- WP: The Effects of Climate Change on a Small Open Economy
- WP: Stranded Assets and the Financial System
- WP: Green Bonds as an Instrument to Finance Low Carbon Transition

Further Research

Monetary Policy

Neo-Keynesian models

- In the energy sector, introduce green renewable energy along with brown fossil fuels.
  - Substitutability assumptions.
  - Fossil fuels pay carbon taxes or buy tradeable permits.
- In the damage function / TFP specification $\widehat{A_t} \equiv e^{-\psi(T_t - T_0)} A_t$, introduce deep uncertainty and ambiguity aversion for the damage parameter ψ.
  - Use robust control methods.
  - Policy uncertainty faced by firms regarding the stringency and the timing of climate change policies.

Central Bank Policy

- In the design of monetary policy, the central bank's objective function is defined in terms of the output gap – the deviation between actual output and its efficient level – and the inflation gap – the deviation between actual and target inflation – of an economy (e.g. Clarida et al. 1999; Gali 2008).
- The central bank takes into account climate change damages on the output gap. This allows us to explore:
  - the link between output gap and inflation,
  - responses to cost push shocks,
  - and interest rate rules.

Central Bank Policy

The problem is:

$$\min_{y_t,\pi_t} \mathbb{E}_0 \frac{1}{2}\sum_{t=0}^{\infty} \beta^t [\alpha(x_t - \psi \Delta T_t^e)^2 + \pi_t^2]$$

$$x_t = y_t - y_t^e \, , \pi_t = p_t - p_{t-1}$$

$$\Delta T_t^e = T_t - T_t^e$$

subject to

$$\pi_t = \beta \mathbb{E}_t[\pi_{t+1}] + \kappa(x_t - \psi \Delta T_t^e) + u_t$$

$$u_t = \rho u_{t-1} + \varepsilon_t$$

$$T_t = \Lambda \exp(\log \gamma_t + y_t) + (1-\delta) T_{t-1}$$

Preliminary Results

- Discretionary policy:

  $\beta \mathbb{E}_t[\pi_{t+1}] + u_t$ is a fixed parameter,

$$x_t = -\frac{\kappa}{\alpha}\pi_t + \psi \Delta T_t^e \ .$$

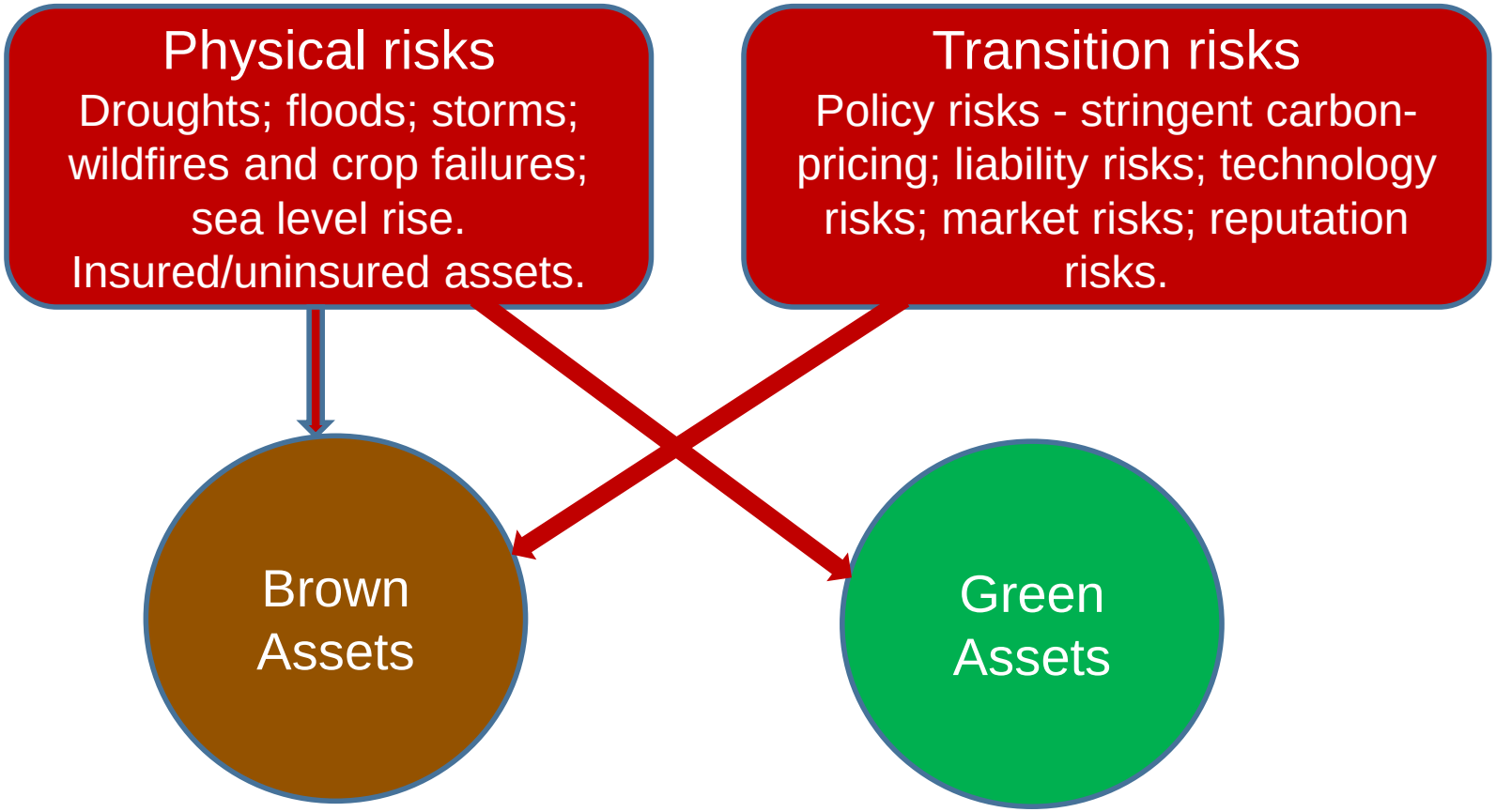
- Optimal policy under commitment:

$$x_t = -\frac{\kappa}{\alpha}\lambda_t + \psi \Delta T_t^e - \frac{\mu_t}{\alpha}\Lambda e^{(\phi_t + x_t)}.$$

The Financial Markets

- The Governor of the Bank of England, Mark Carney, was the first to highlight the threat of climate change for the stability of the financial system and to identify the risks involved ("Breaking the tragedy of the horizon", 2015).
- Are climate-related risks properly reflected in asset pricing?

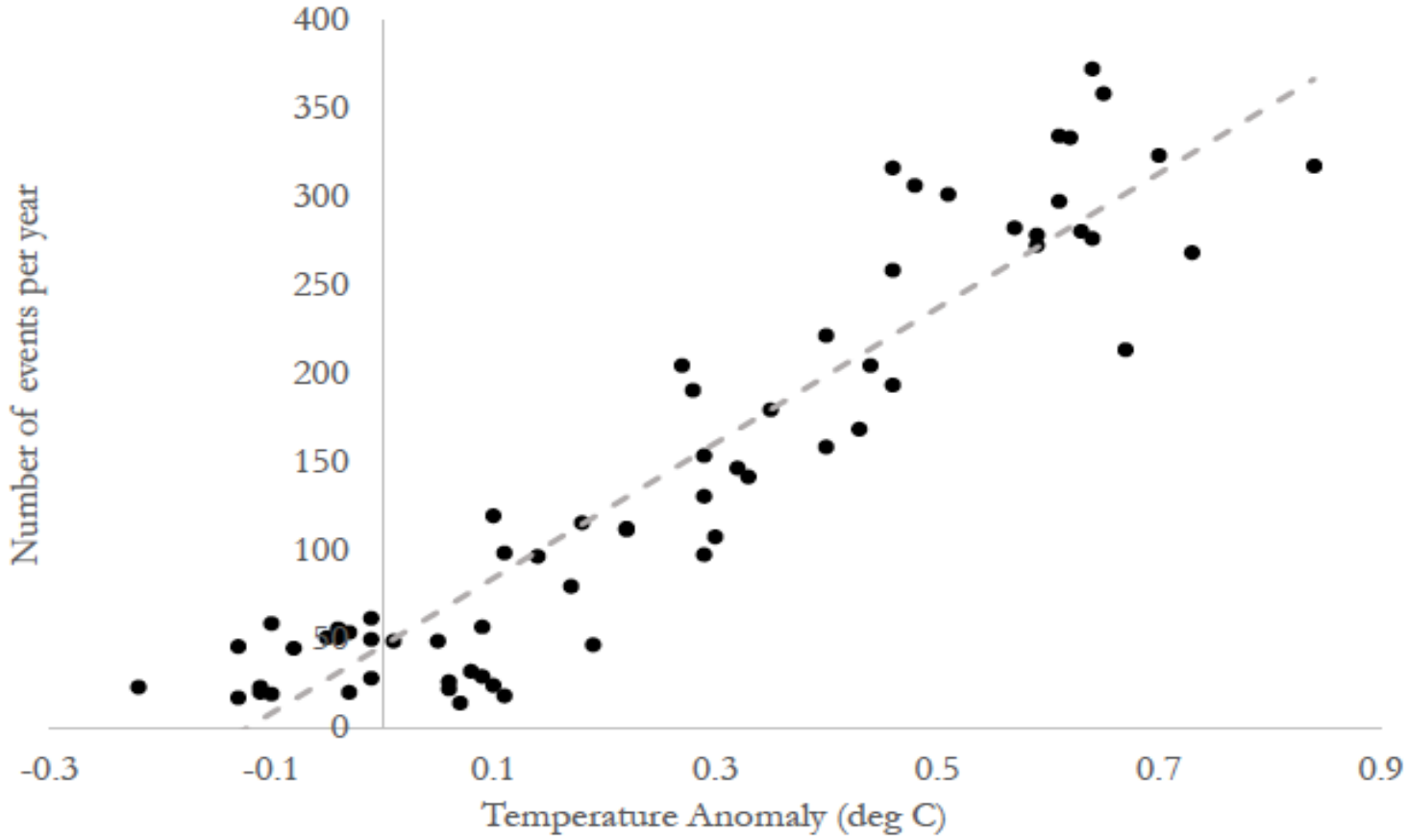
Financial Risks from Climate Change



Asset Pricing

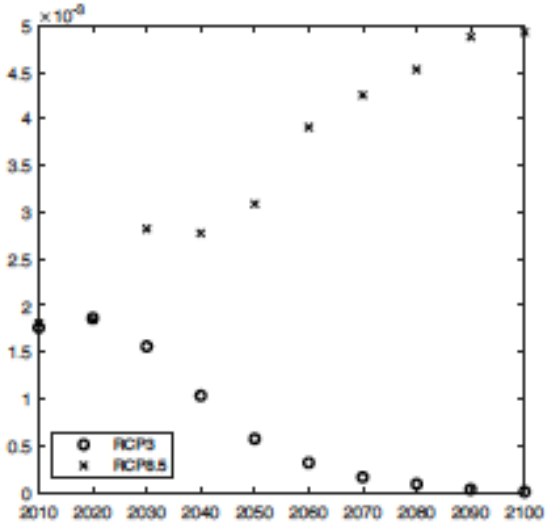
- CAPM with brown/green assets and
- Rare disasters
  - Macroeconomic (e.g. wars, recessions). Barro's approach to asset-pricing puzzles)
  - Climate disasters related to brown assets
  - Climate policy cost to brown assets related to the arrival of climate disasters

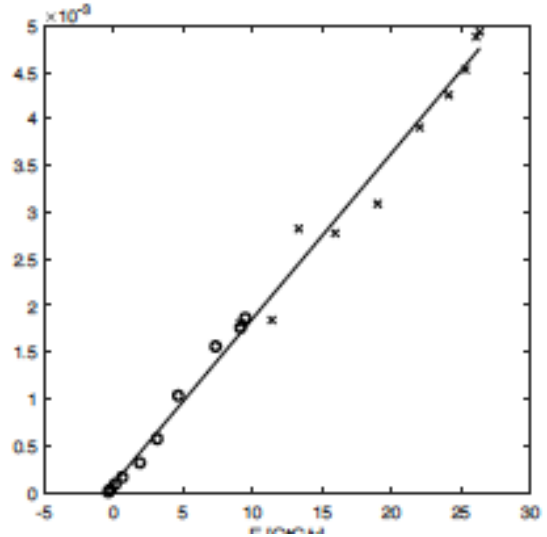
Environmental Disasters



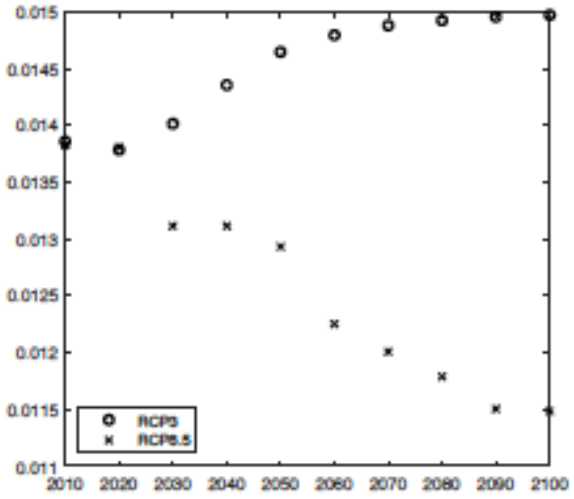
Karydas C. and A. Xepapadeas, (2019), Pricing climate change risks: CAPM with rare disasters and stochastic probabilities, ETH WP.

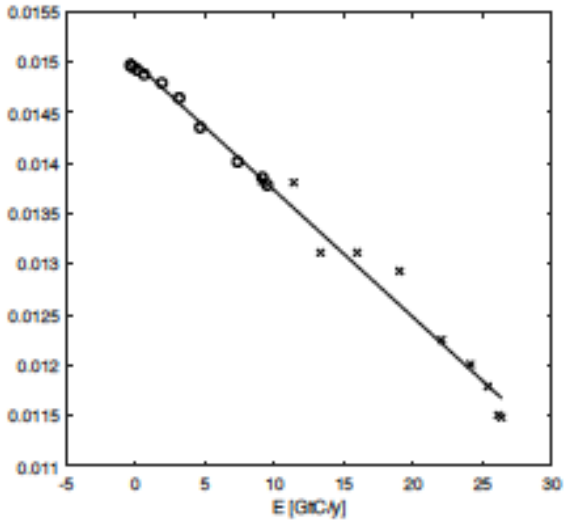
The premium of climate change risk (annual terms)



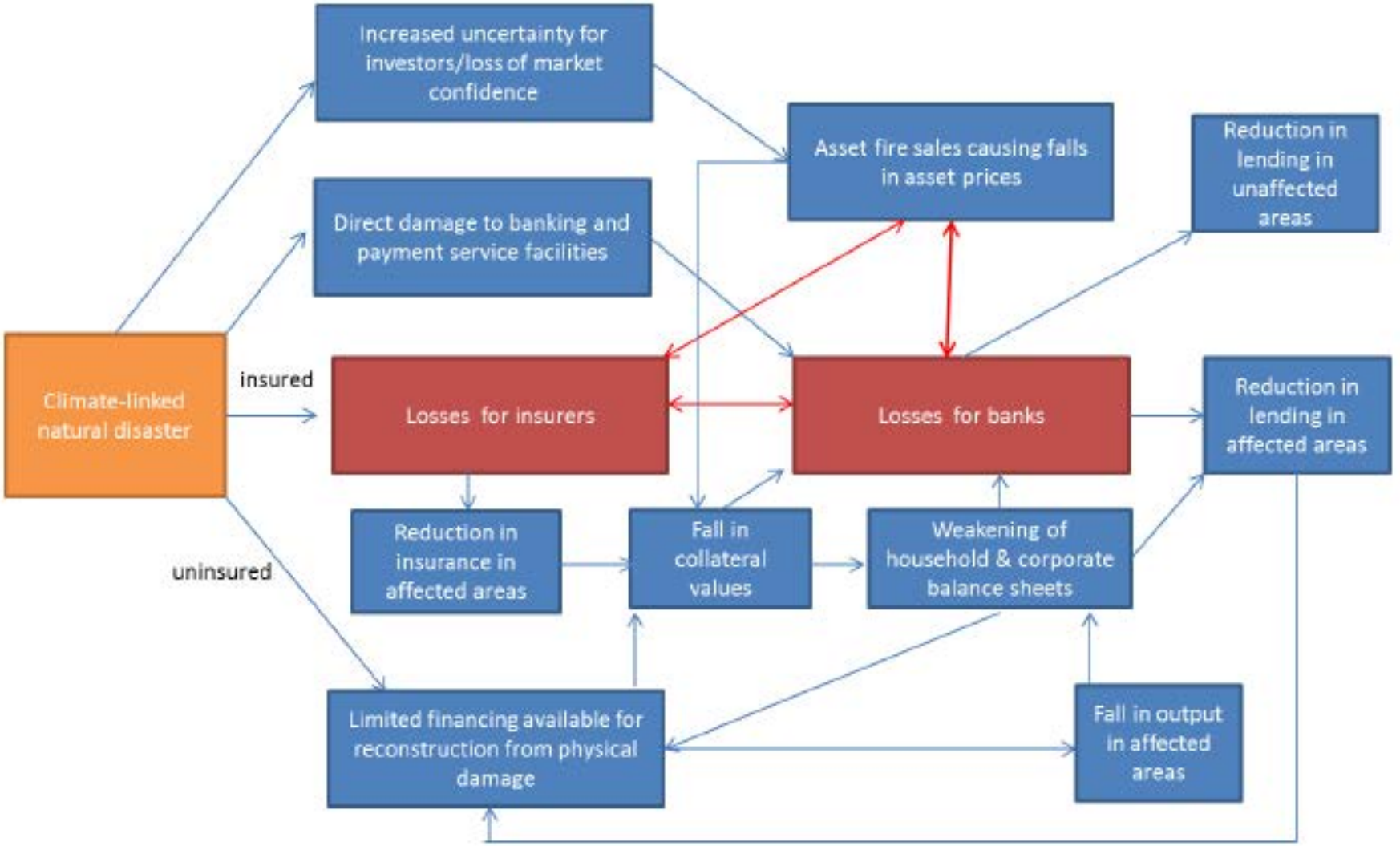


The effect of emissions on government bond yield (annual terms)





A transmission map from a natural disaster to financial sector losses and the macroeconomy



Batten et al. (2016), Let's talk about climate change: the impact of climate change on central banks, Bank of England, WP No 603.

Additional Areas of Research

- The exposure of the Greek financial system to carbon intensive assets and the possible financial risks from the emergence of stranded brown assets
- The liabilities of the insurance system to physical climate change risks
- The extent to which assets are uninsured with respect to climate change risks
- The structure of a potential green macroprudential policy which will facilitate the introduction of green technologies

Additional Areas of Research

- Green bonds policies which facilitate the transition to a low-carbon economy and support the Greek program of adaptation to climate change
- The appropriate discount rate and the price of carbon to be used in cost benefit analysis of projects associated with transition to a low-carbon economy and adaptation to climate change
- The aggregate damage function from climate change for the Greek economy
- The vulnerabilities of the Greek economy to climate change at both the regional and the sectoral levels