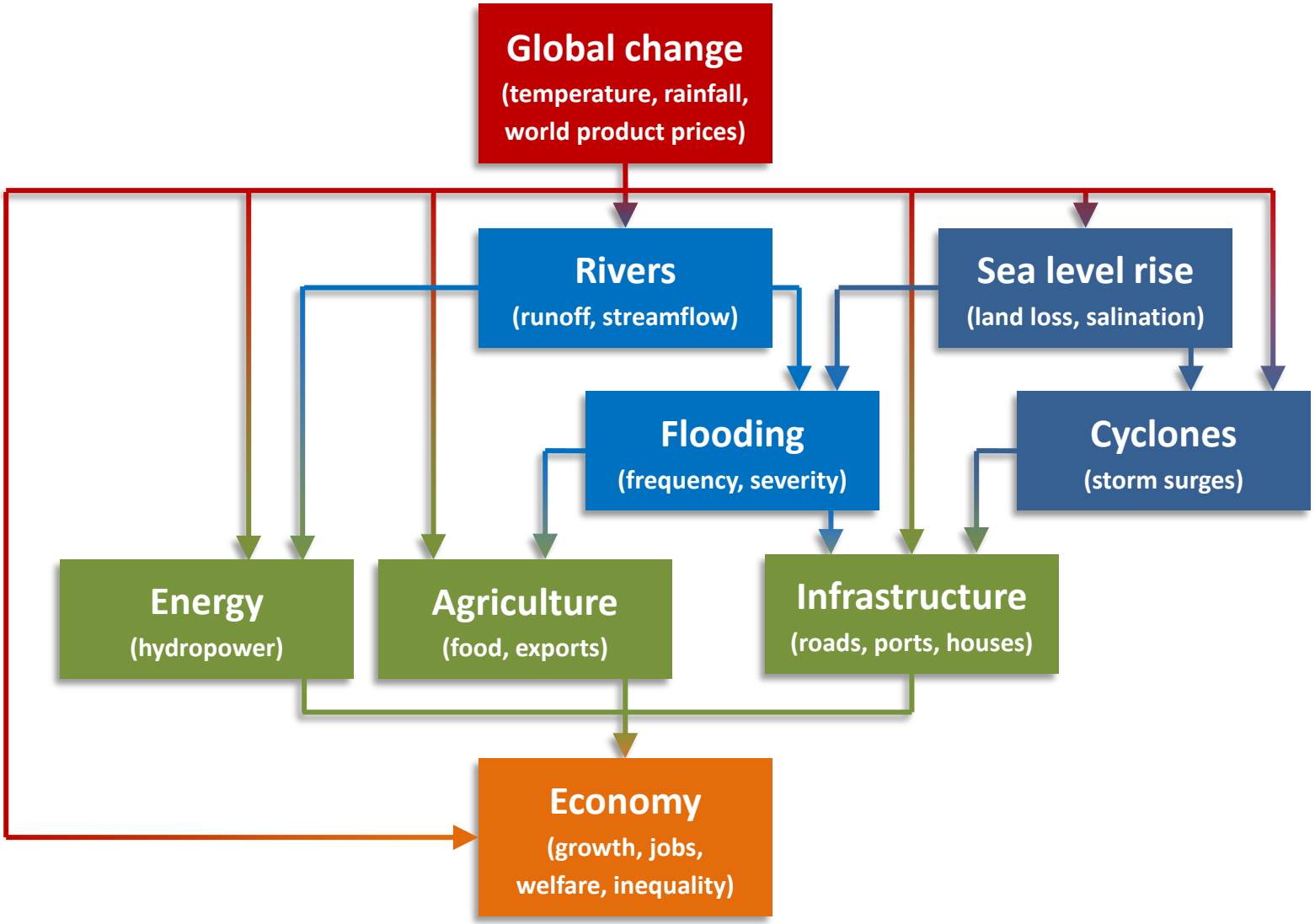
UNITED NATIONS UNIVERSITY
World Institute for Development Economics Research

Climate Uncertainty and Economic Development: The Case of Mozambique

Channing Arndt with many others

Multi-sector Modeling Framework



Measuring Economywide Impacts

- **Country CGE model of Mozambique**
- **Substantial structural detail**
  - Sub-national agricultural regions
  - Detailed sectors, labor markets, and household groups
- **Recursive dynamic**
  - Capital accumulation based on past investment
  - Productivity growth linked to sector models
  - Autonomous adaptation (“typical farmer”, market mechanisms)

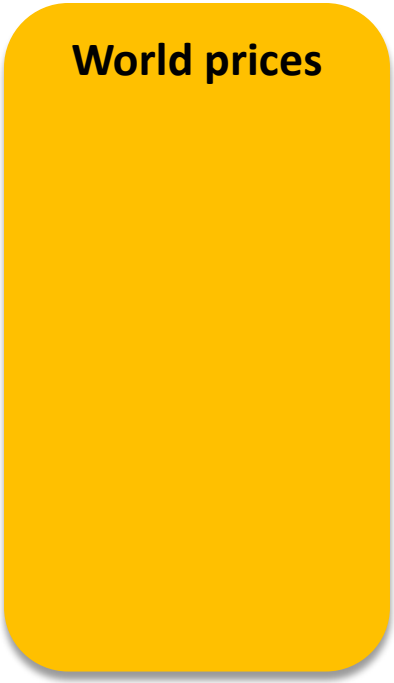
Baseline "No Climate Change" Scenario

- Baseline specifies a future scenario reflecting development trends, policies, and priorities under historical climate.

- Assumes reasonable growth trajectory and structural change
  - Labor supplies grow at 1.4% based on UN population projection
  - Economy expands at 5% per year (or 3.6% in per capita terms)
  - Land expands more slowly than population/labor supply
  - Agriculture's share of GDP falls from 22.5% in 2007 to about 10% in 2050

- Baseline is consistent with sector models' baselines
  - CGE captures individual baselines and their interactions within a market economy
- Take world prices from the same global economic model that generated the global emissions paths that drive the climate model.

Layering the Impact Channels



Global fuel and food prices

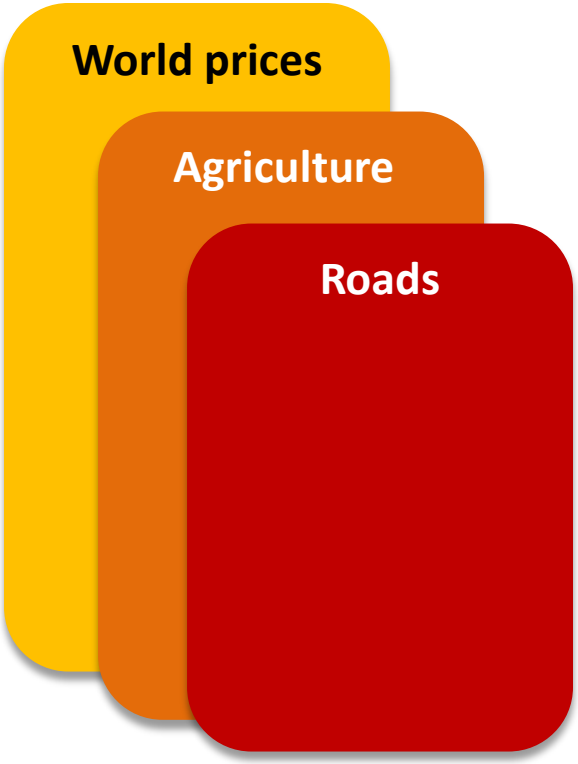
Product-level projections from global economic model imposed on country's import and export prices

Layering the Impact Channels

Crops and livestock

Yield deviations from crop models imposed on crop production functions

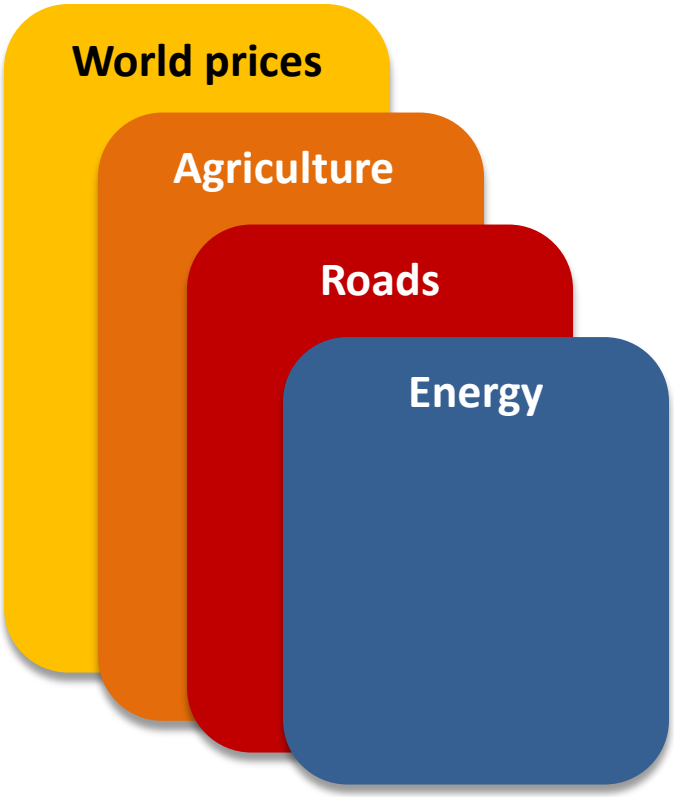
Layering the Impact Channels



Road infrastructure

Deviations in total road network length imposed on productivity of transport services

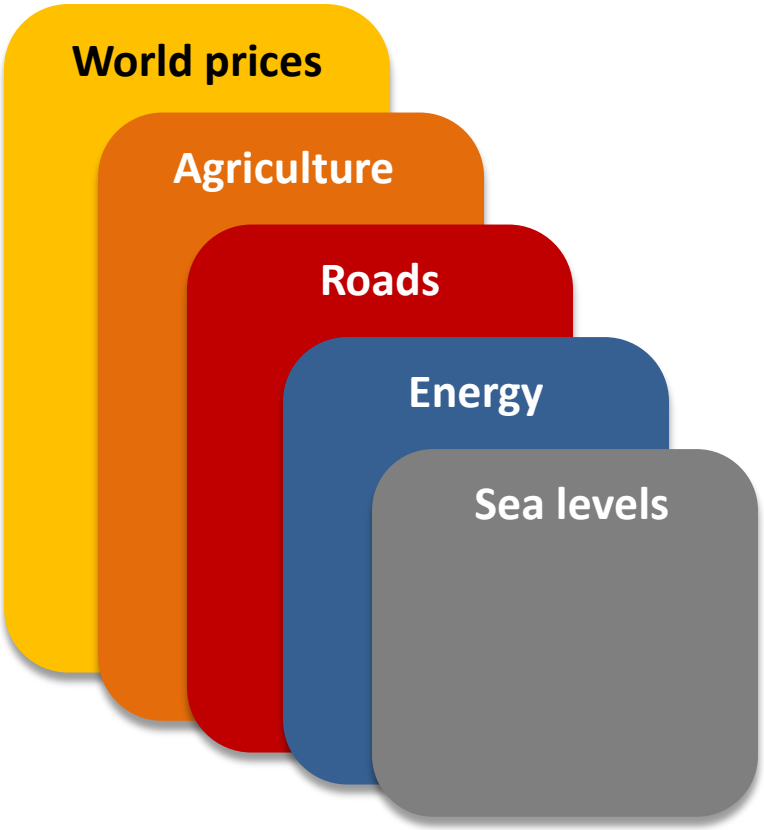
Layering the Impact Channels



Hydropower generation

Projections from river basin and water management models determines hydropower energy supply

Layering the Impact Channels



Sea level rise

Sea level rise projections from spatial elevation model (DIVA) reduces crop land availability

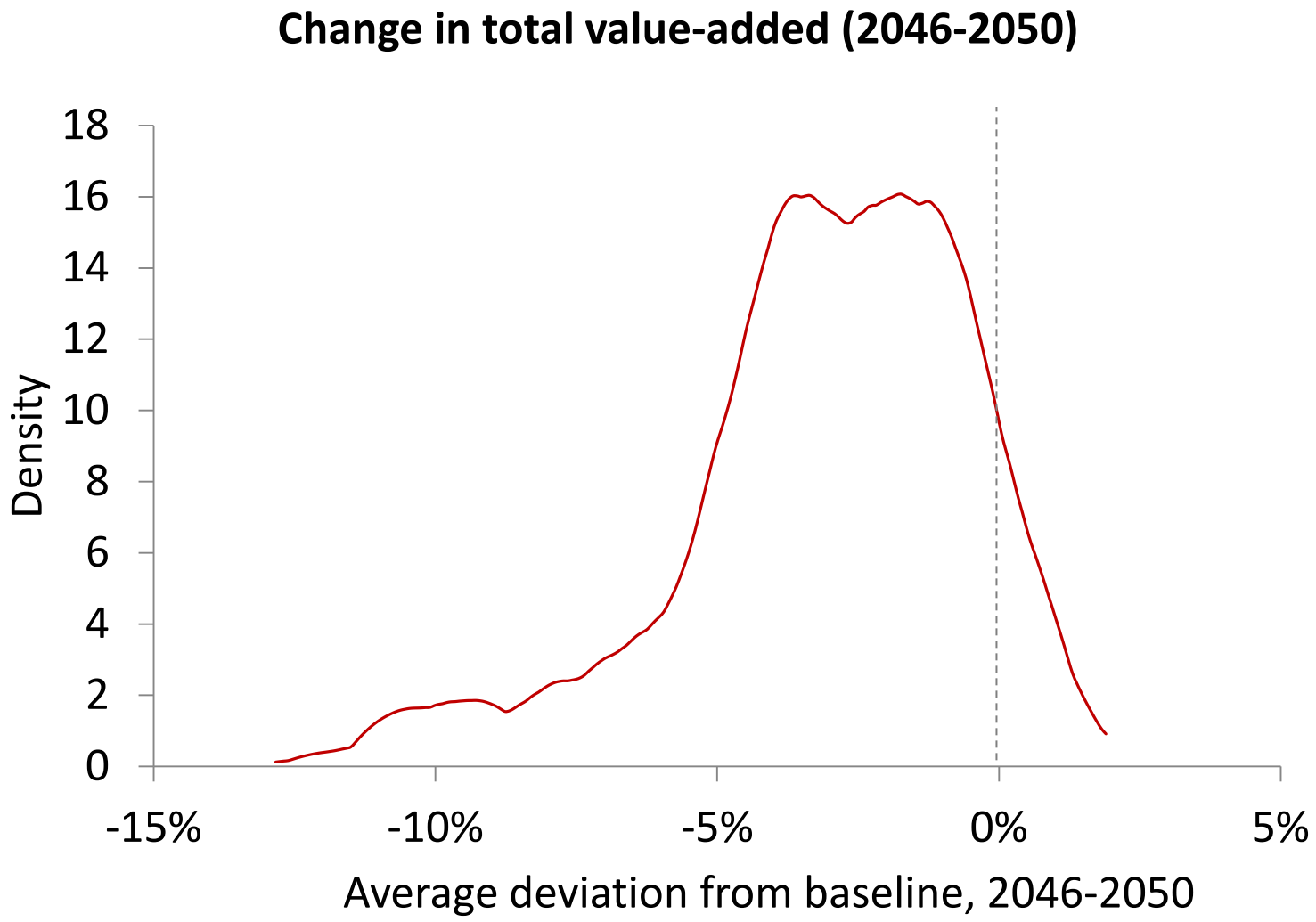
Layering the Impact Channels

Cyclones and storm surge damages

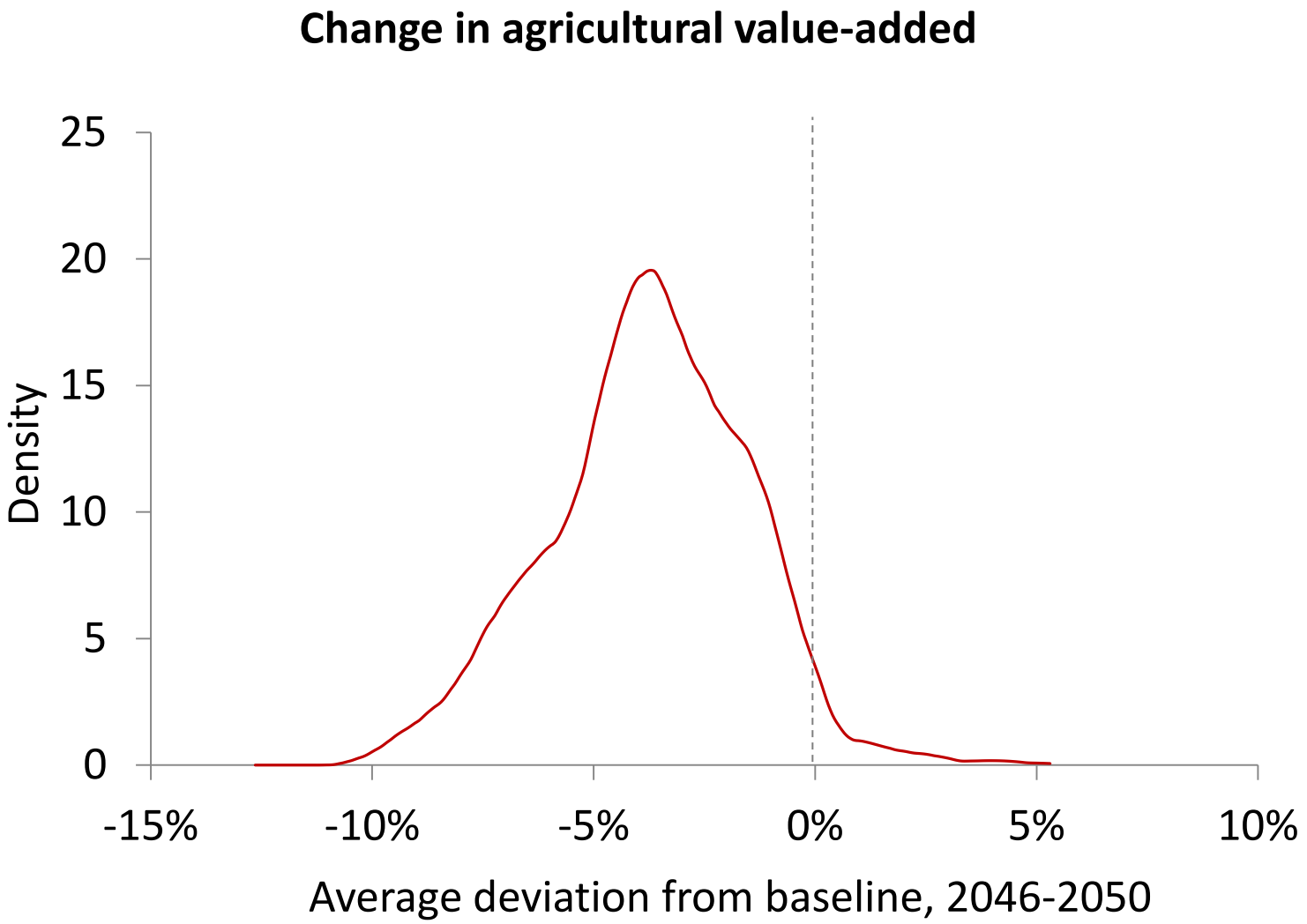
Storm surge projections damages capital stocks in nonagricultural sectors

Implications of Unconstrained Emissions

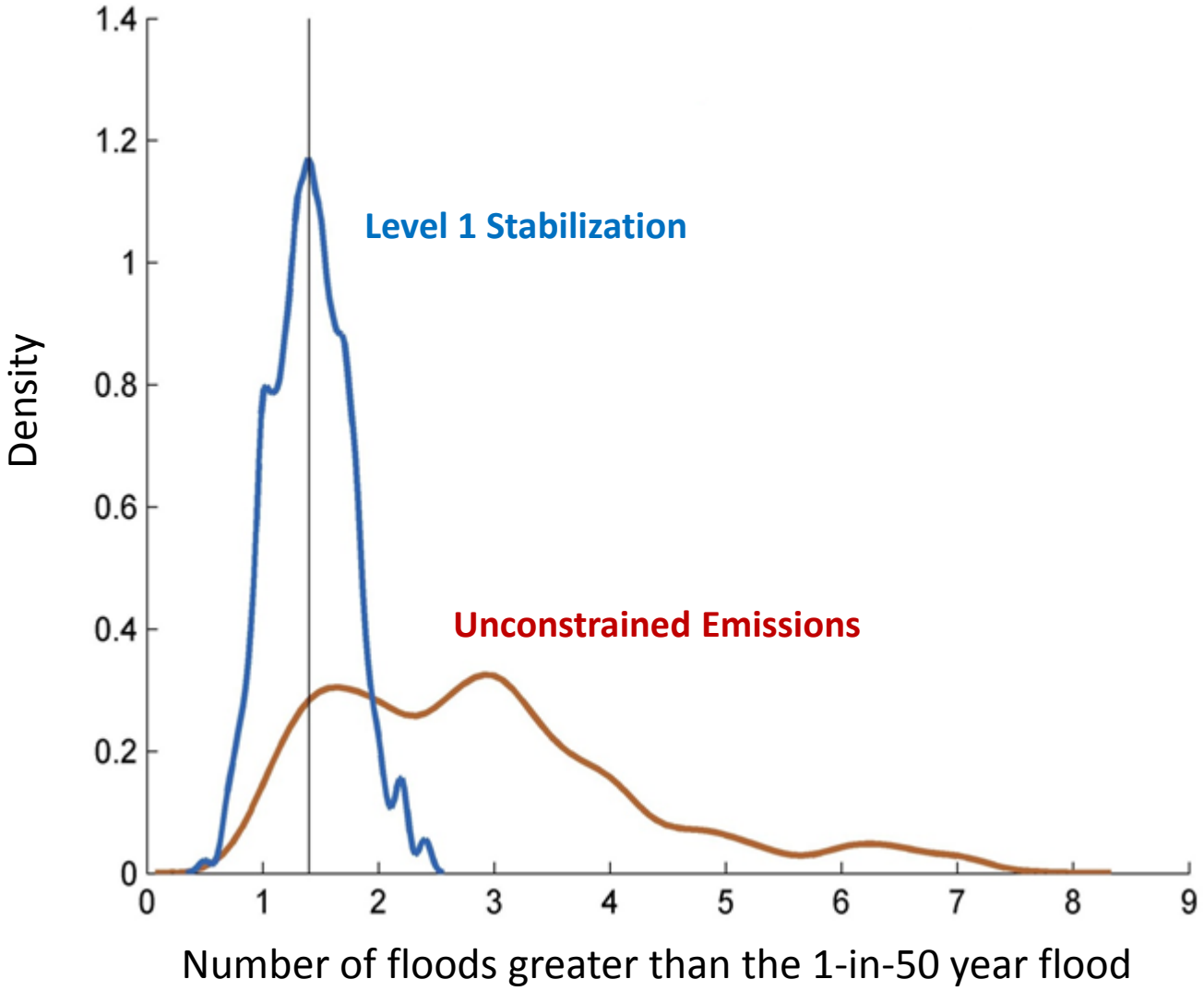
Changes in Gross Domestic Product (GDP)



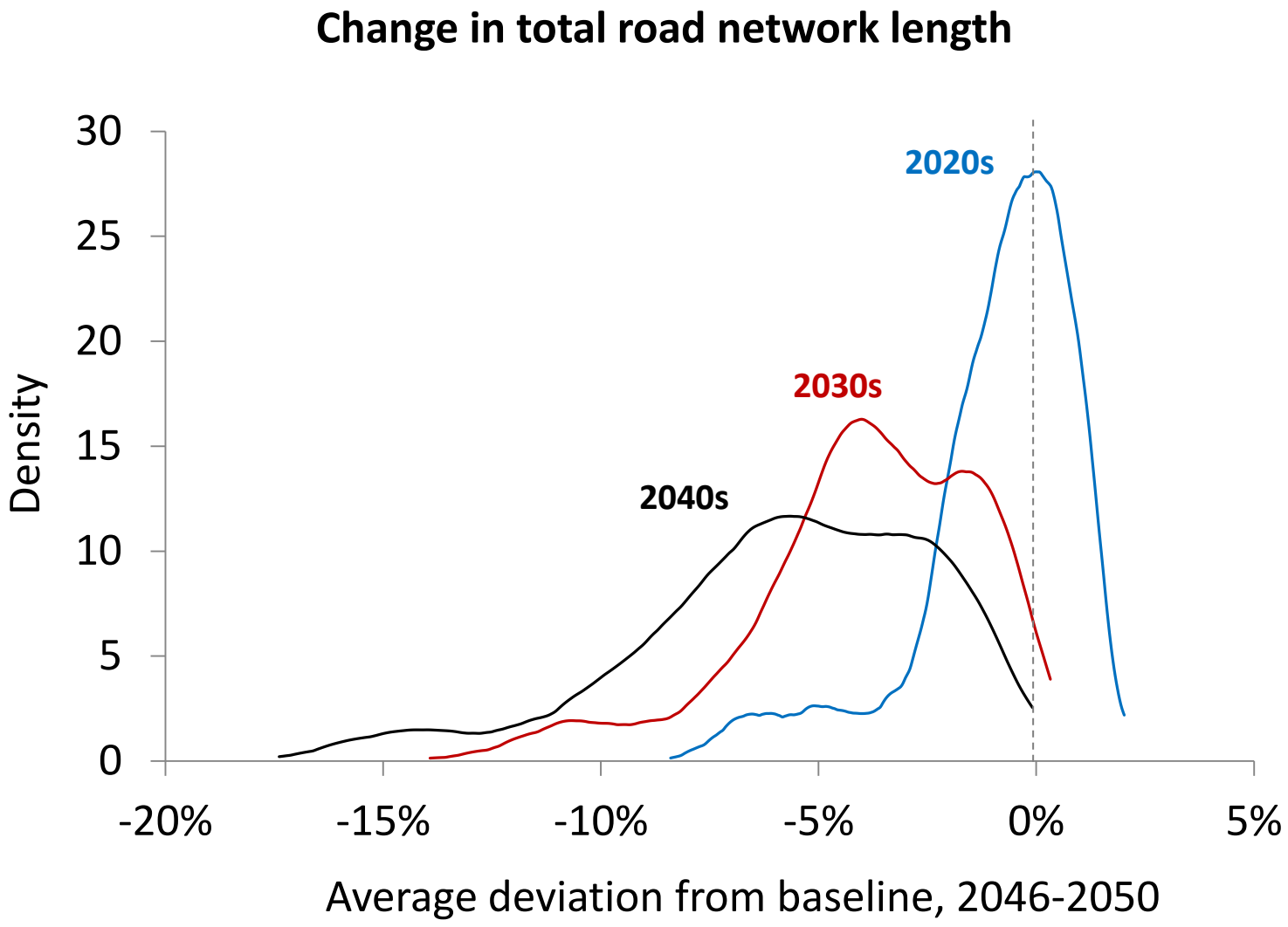
Agriculture



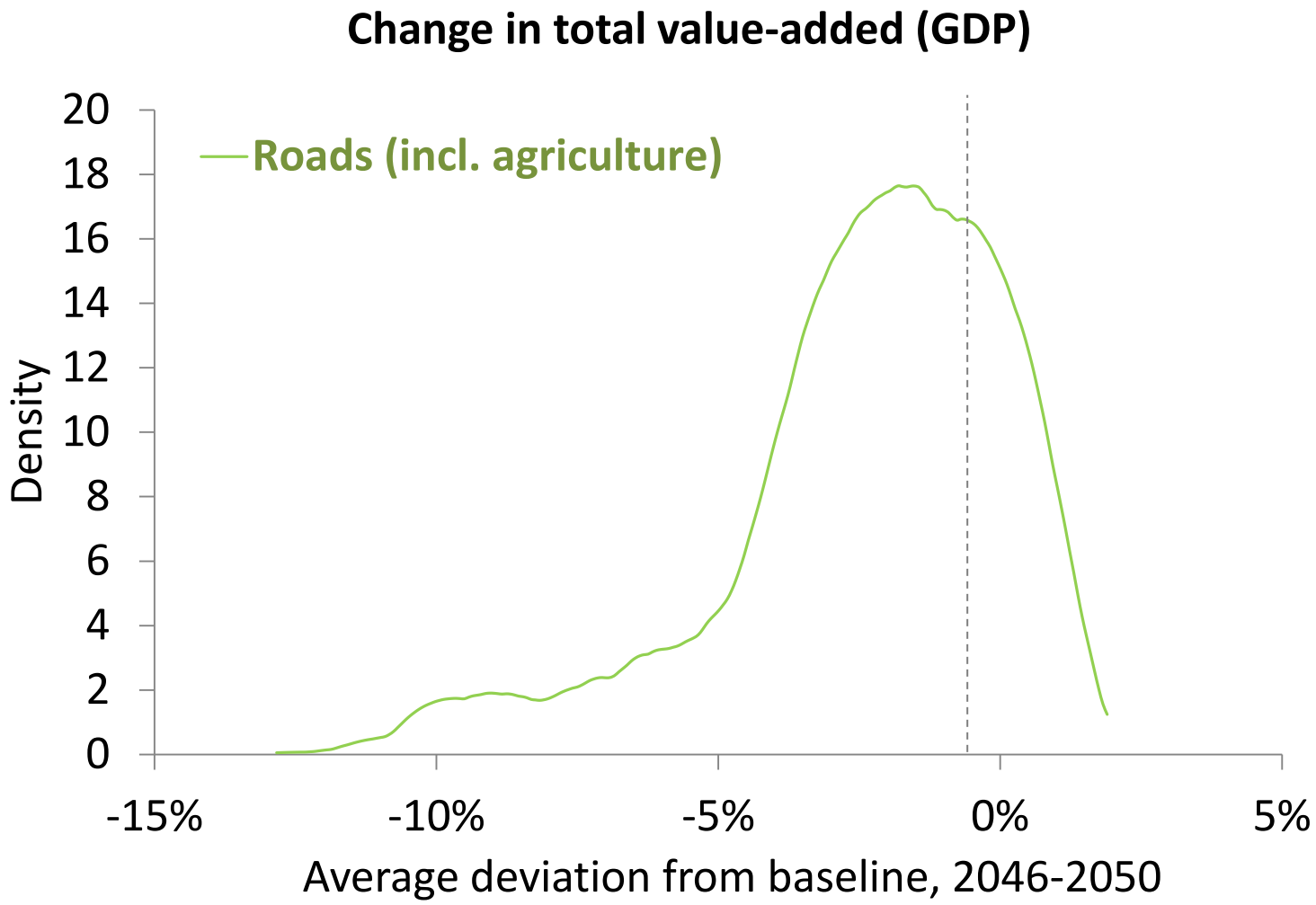
Flooding Projections for Mozambique



Implications for Road Infrastructure



Roads, Energy, Sea Levels and Cyclones



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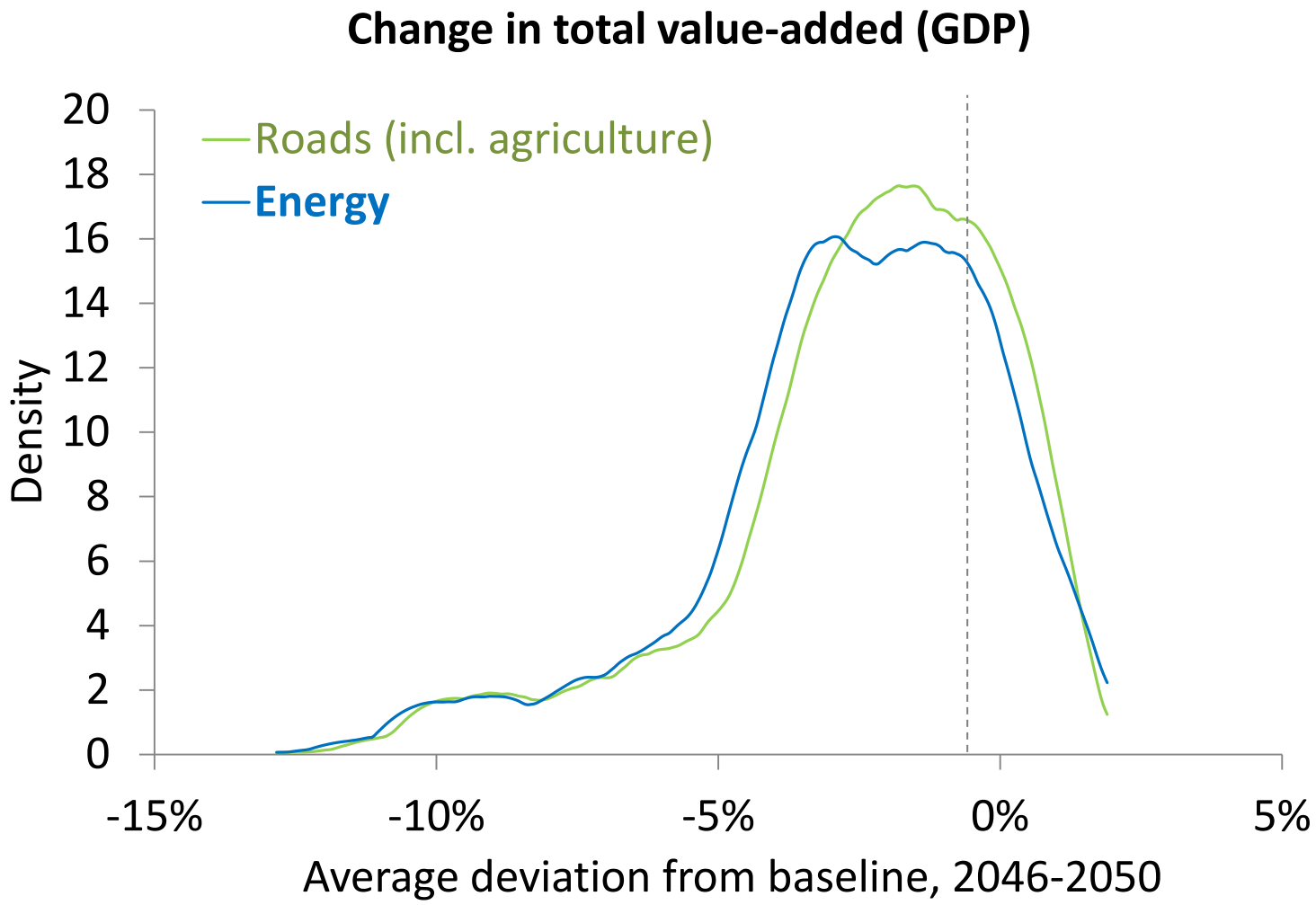

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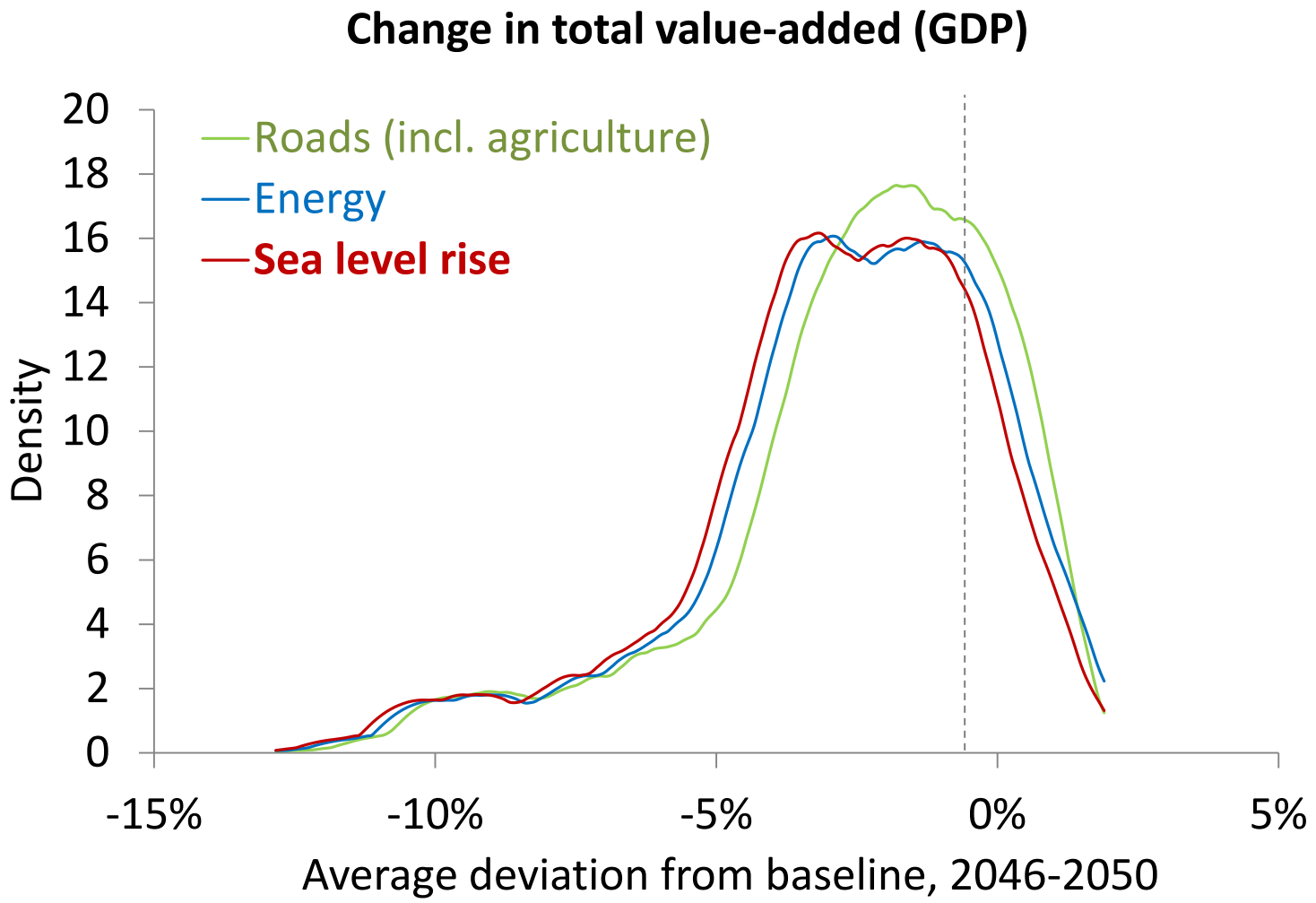

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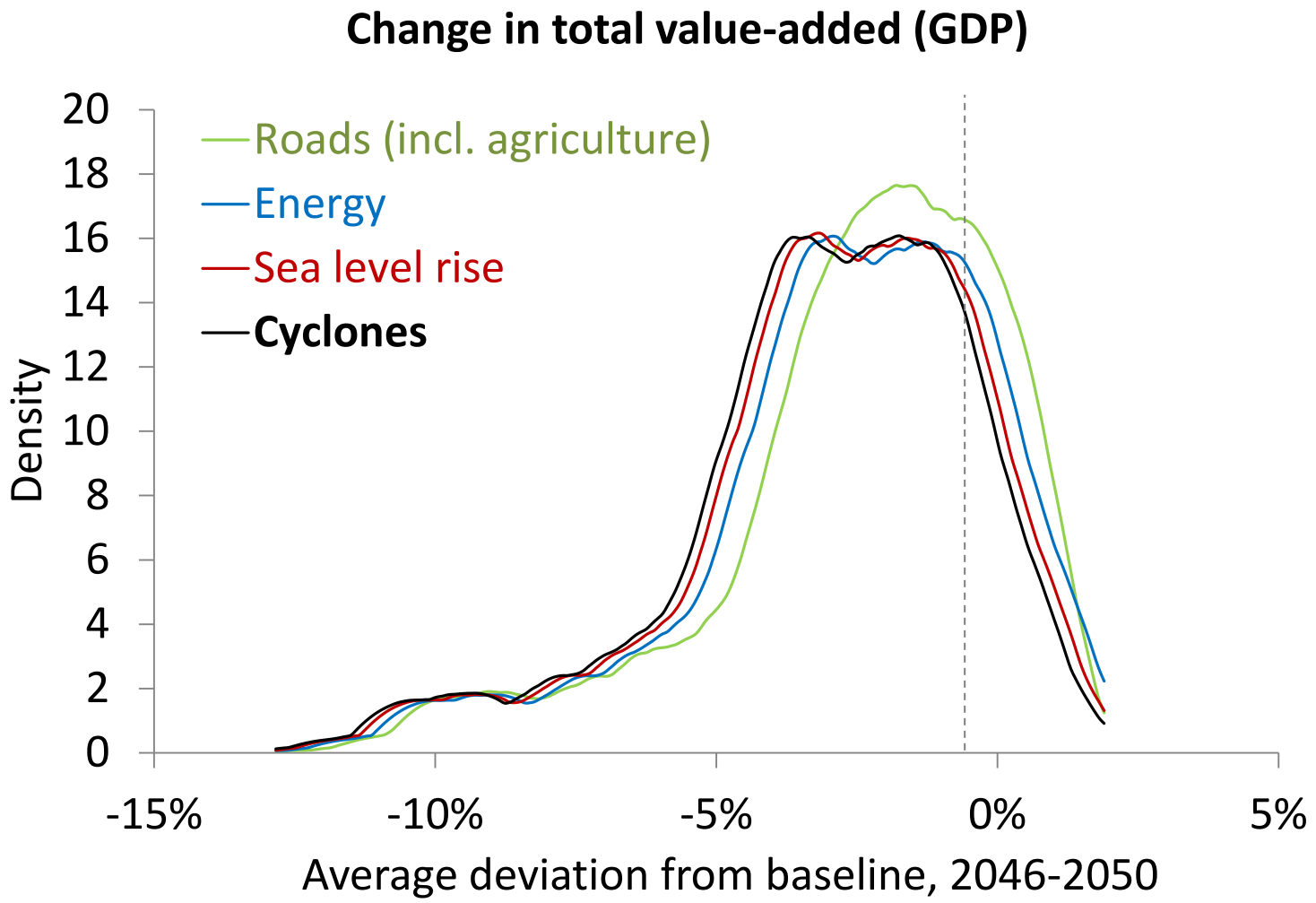
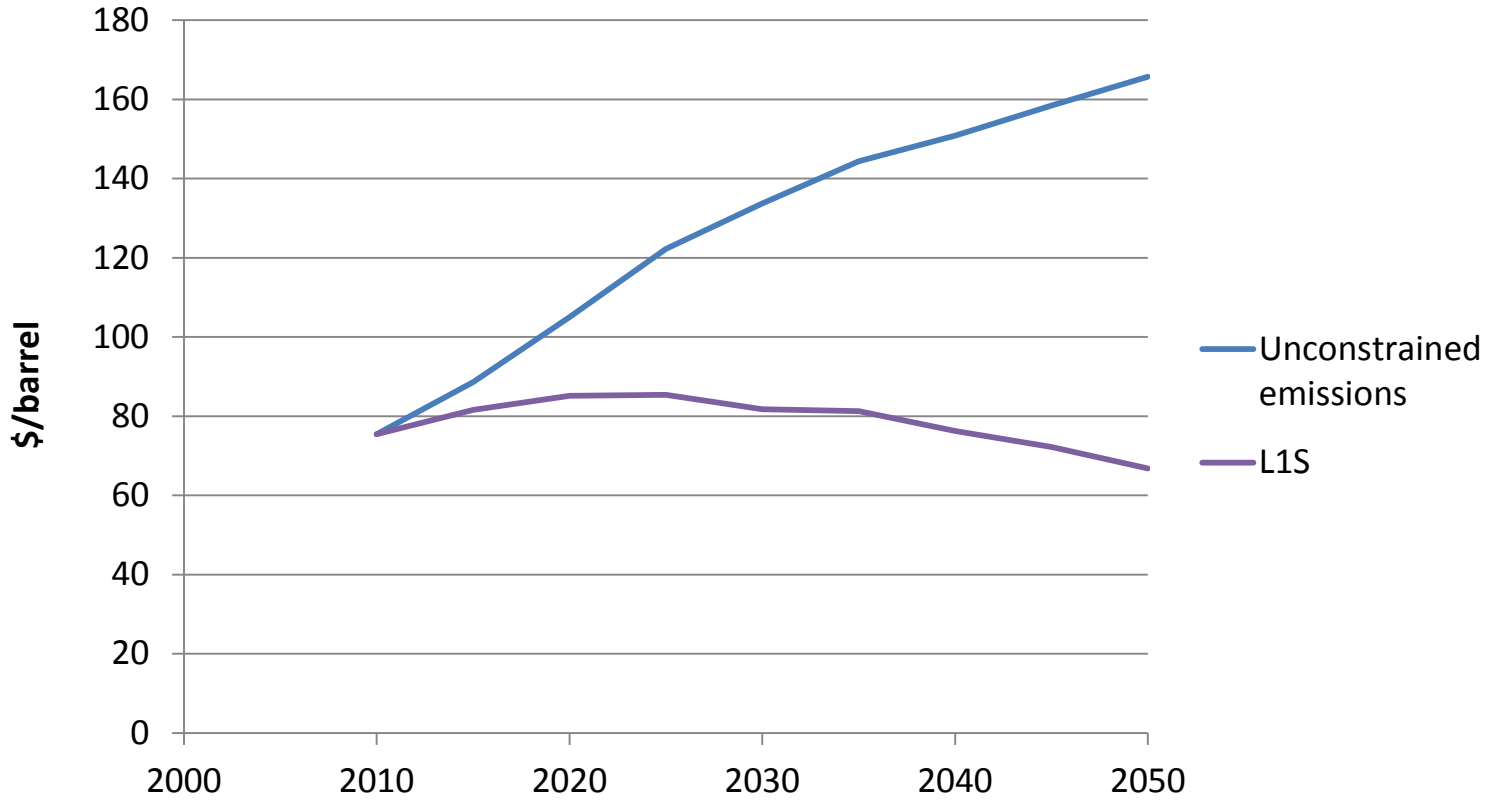
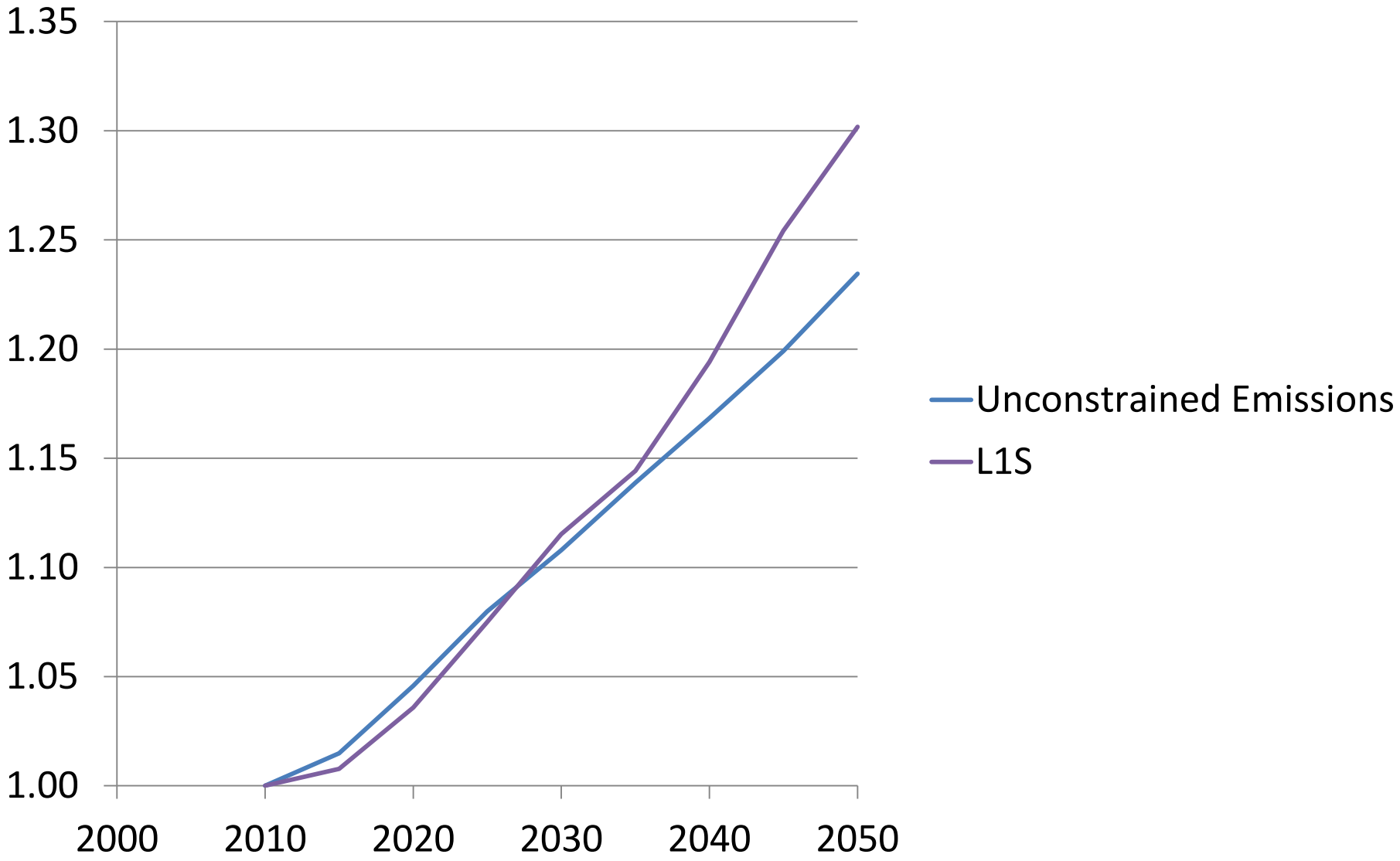


Implications of Stabilization Policy (Unconstrained emissions versus L1S)

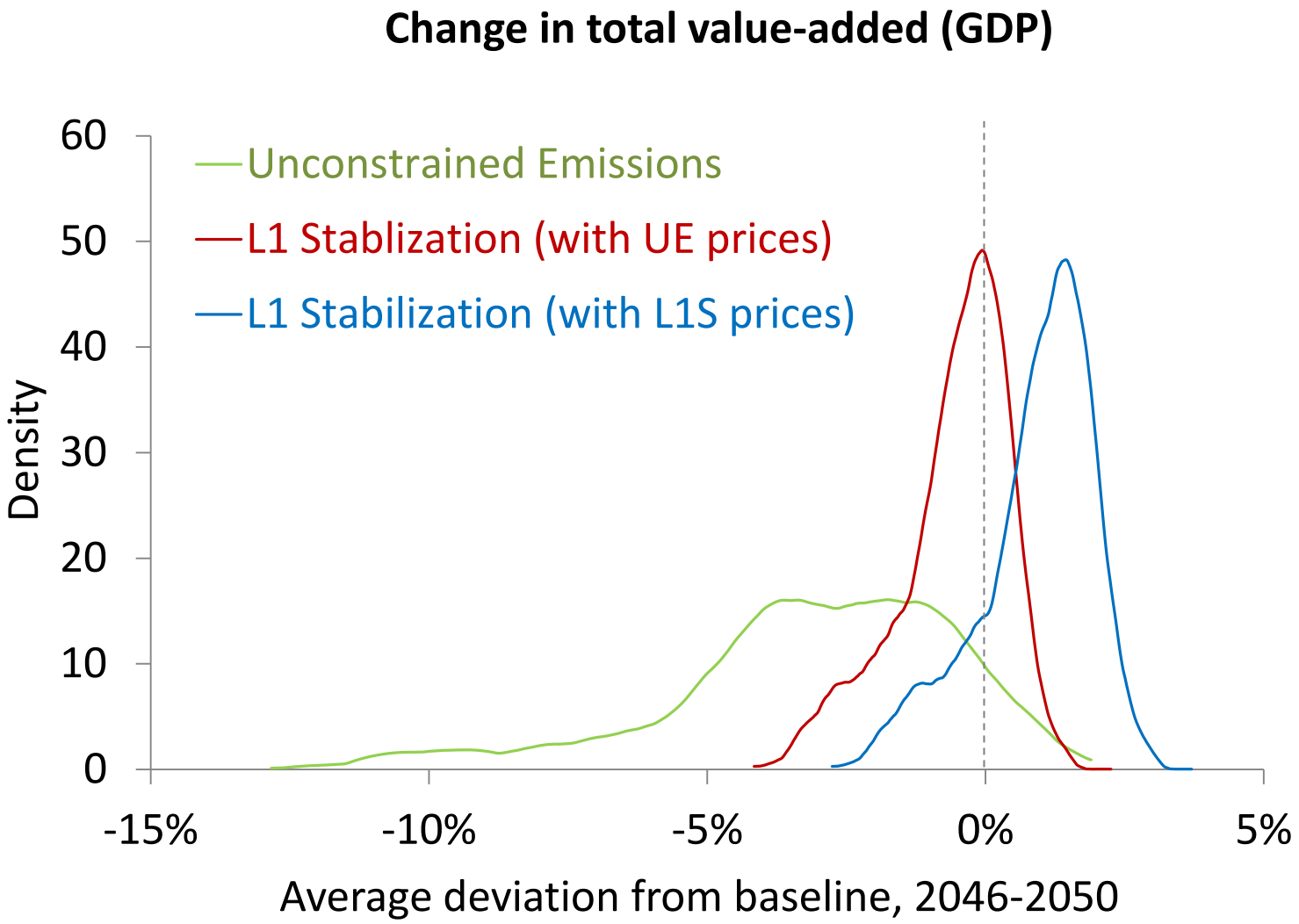
World Oil Producer Prices (Unconstrained emissions versus L1S)



World Agricultural Price Index (Unconstrained emissions versus L1S)



Effects of Global Mitigation Policy



Summing Up (1)

- **To inform development policy, researchers must address the uncertainty and complexity of climate change**
- **Inadvisable to design policy using single climate projections**
  - Not all impacts are strongly negative (at least until 2050)
  - Extreme events can drive outcomes (esp. flooding)
  - Supports a probabilistic approach to climate uncertainty
- **Multi-sector approaches are essential**
  - Agriculture is an obvious impact channel, but yield impacts are not necessarily the most important for overall economic growth
  - Damages to assets/infrastructure may have longer lasting implications

Summing Up (2)

- **Even small reductions in long-run growth rates can be important**
  - A small drop in capital accumulation rates cumulate into large reductions in GDP by 2050
  - We assume no change in underlying agricultural TFP growth
- **Today, the implications of climate change for large-scale long-run investment decisions are the most relevant**
  - Roads, energy (esp. hydropower), and agricultural R&D
  - Guide researchers and policy-makers towards priority adaptation areas
- **Mozambique benefits substantially from strong global mitigation policy even by 2050.**
  - Gains on average from a more certain and less severe climate
  - Gains in terms of risk reduction as the “bad tails” of the distribution are reduced or eliminated.
  - Gains in terms of trade due principally to lower oil prices
  - This is likely to be true for many least developed economies

5. Looking Forward

- Compare results for Malawi, Mozambique and Zambia
- Consider participation in global mitigation policy regimes (at what cost to economic development?)
- Consider regional strategies, especially with respect to energy including hydropower and biofuels
- Continued analysis of the genesis and impacts of flood events.