A Probabilistic Analysis of Future Global CO2 Emission Baselines

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Questions

- What are the key determinants of future CO2 emissions?
- What can we say about them?
- What are their relative importance?

Kaya Identity

The growth rate in emissions = the growth rate in GDP

- the decline rate of energy use per unit of output

- the decline rate of CO_2 emissions per unit of energy use

Key Parameters in MERGE Related to the Kaya Identity

- Potential GDP growth rates
- Energy per unit of economic output
  - Elasticity of price induced substitution
  - Rate of autonomous energy efficiency improvements (AEEI)
- Carbon per unit of energy
  - The availability of economically competitive carbon-free alternatives to coal fired electricity
  - The cost of a non-electric backstop alternative to liquid fuels

Poll

- Sent to thirty individuals
- 73 percent response rate
- Responses were requested in terms of 10^{th}, 30^{th}, 50^{th}, 70^{th}, and 90^{th} percentiles
- Average and median responses lay reasonably close together
- Relied on poll averages

Recognize that there is much room for improvement in this approach, but feel that it nevertheless provides some useful insights

Potential GDP Growth Rates

– Variation of potential GDP from the reference case

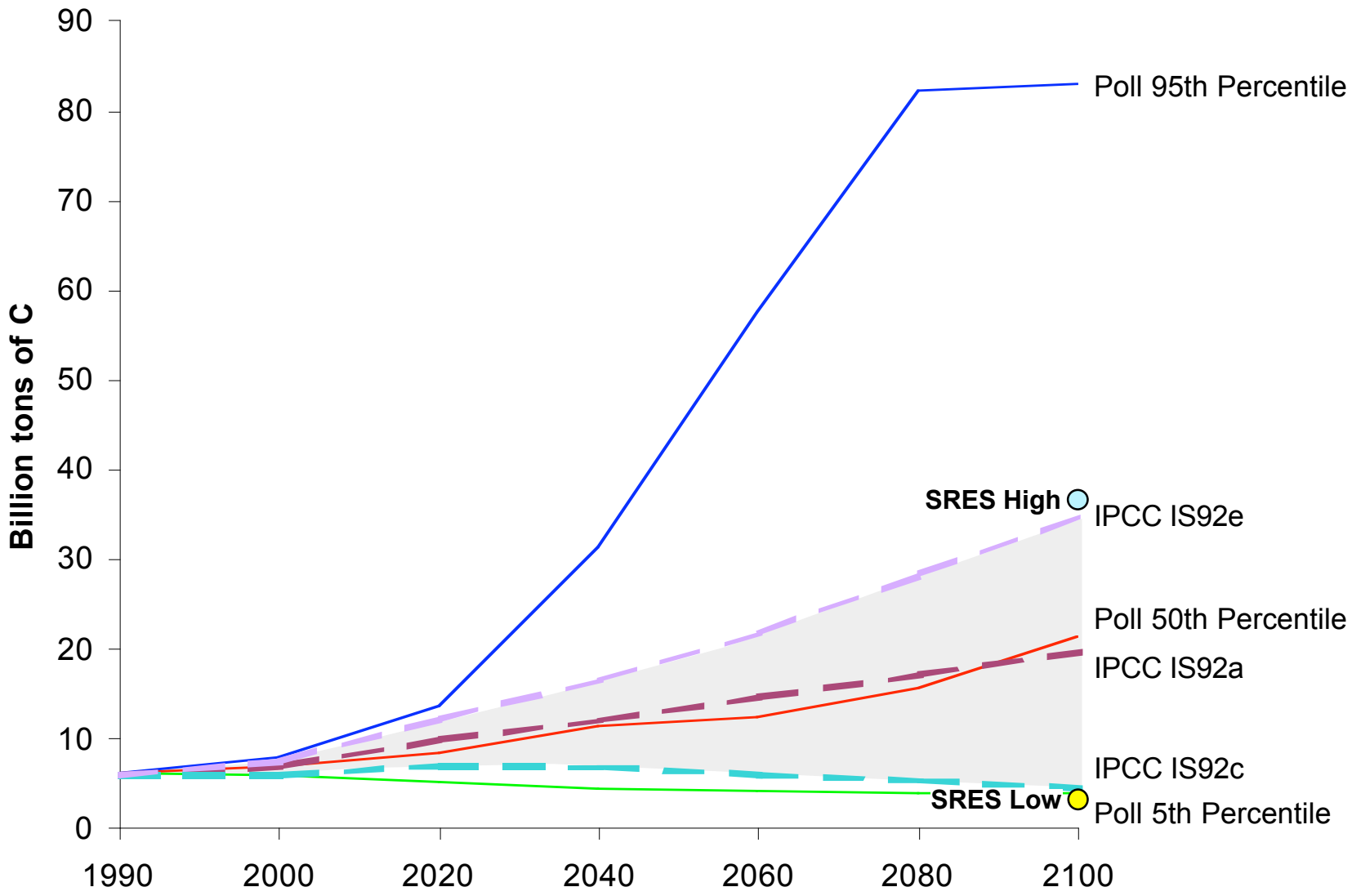
Energy Use Per Unit of Economic Output

- Price induced conservation
  - Percentage increase or decrease relative to the reference case
- AEEI
  - Average rate over the next century

Carbon Per Unit of Energy Use

- Availability of low cost economically competitive substitutes
  - Cost of non-electric backstop
  - Introduction date for carbon-free electric technology

Comparison Between Poll and IPCC



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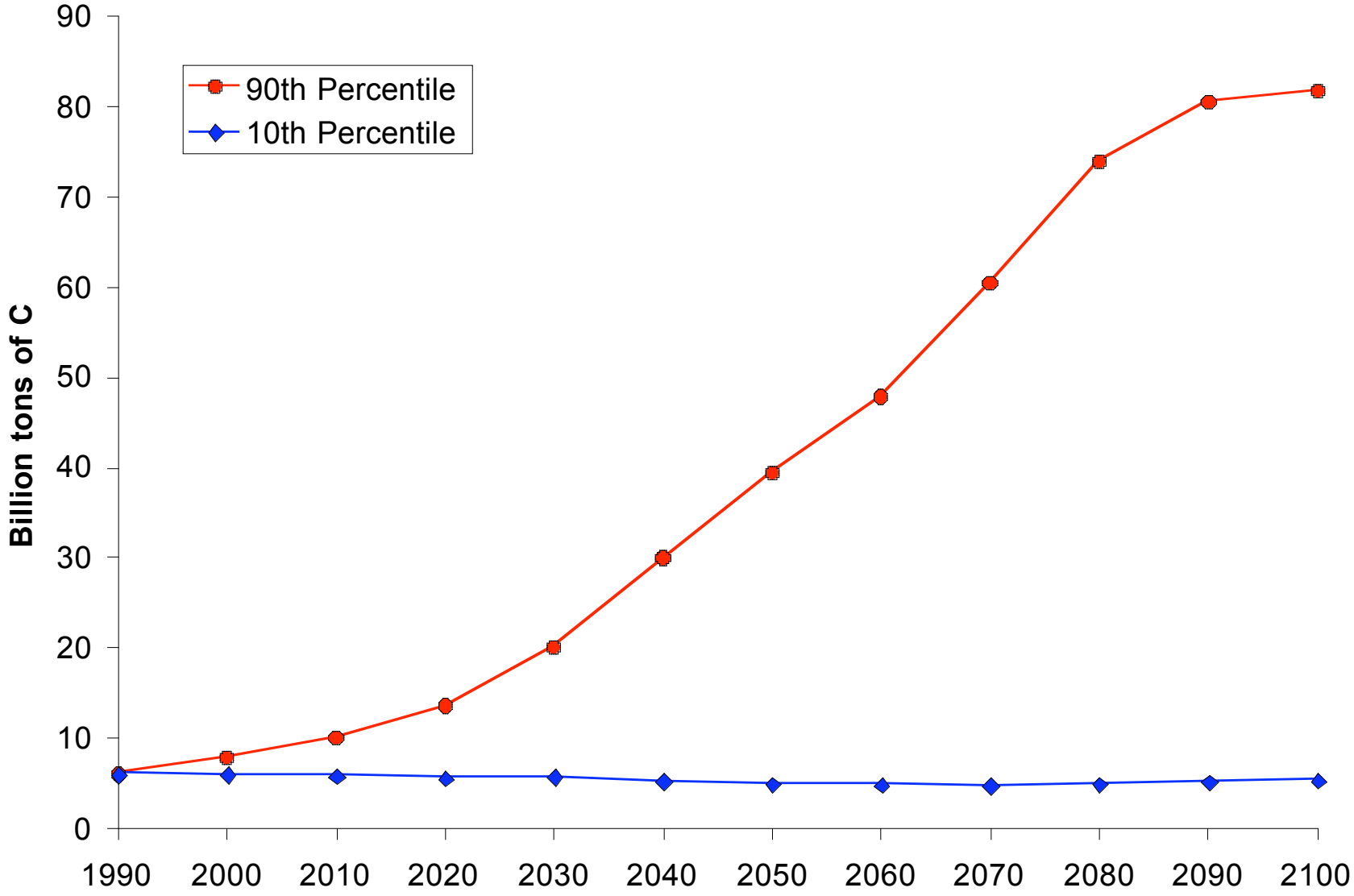
Sensitivity of Emissions to GDP Growth Assumptions



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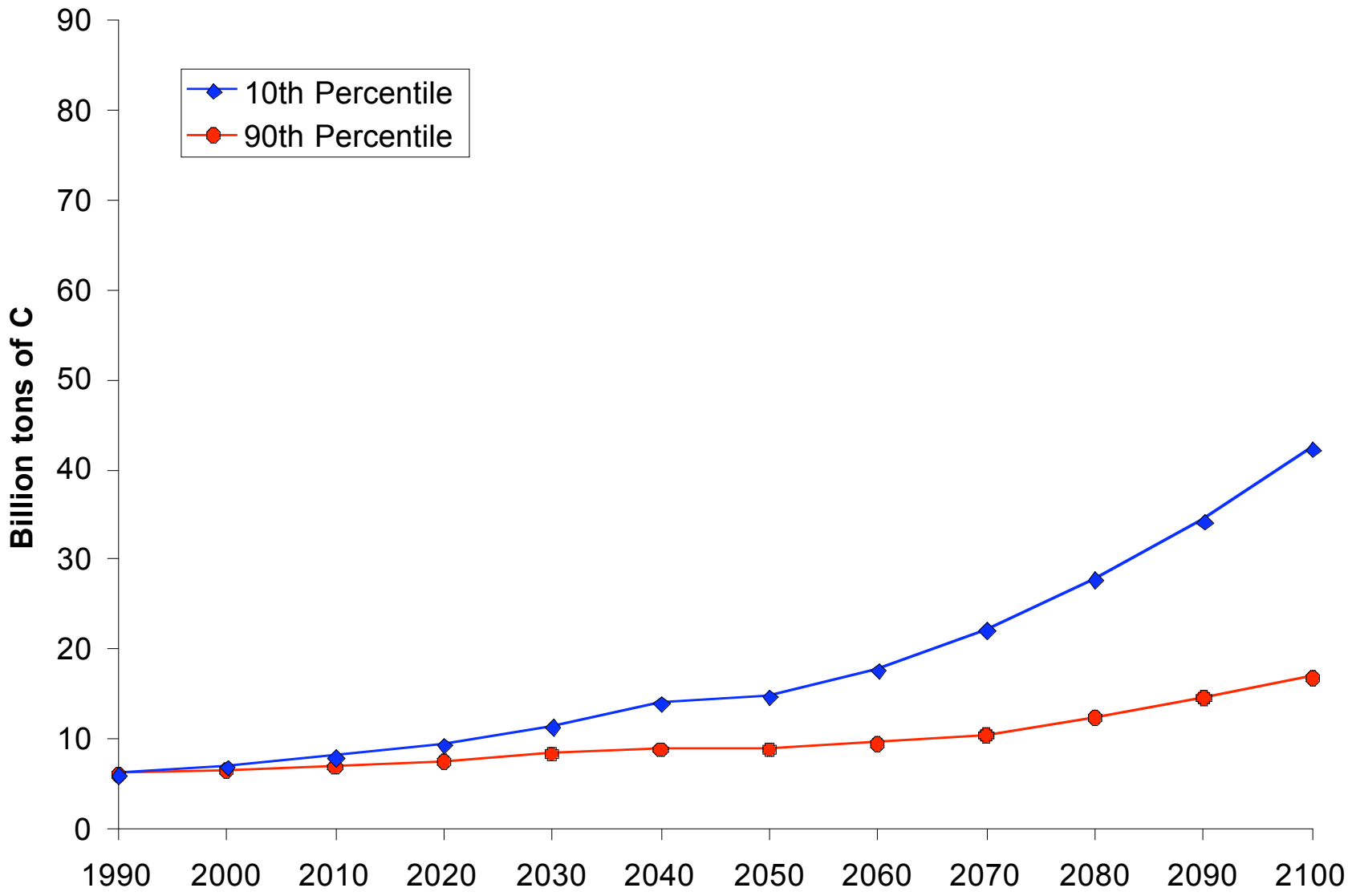
Sensitivity of Emissions to AEEI Assumption



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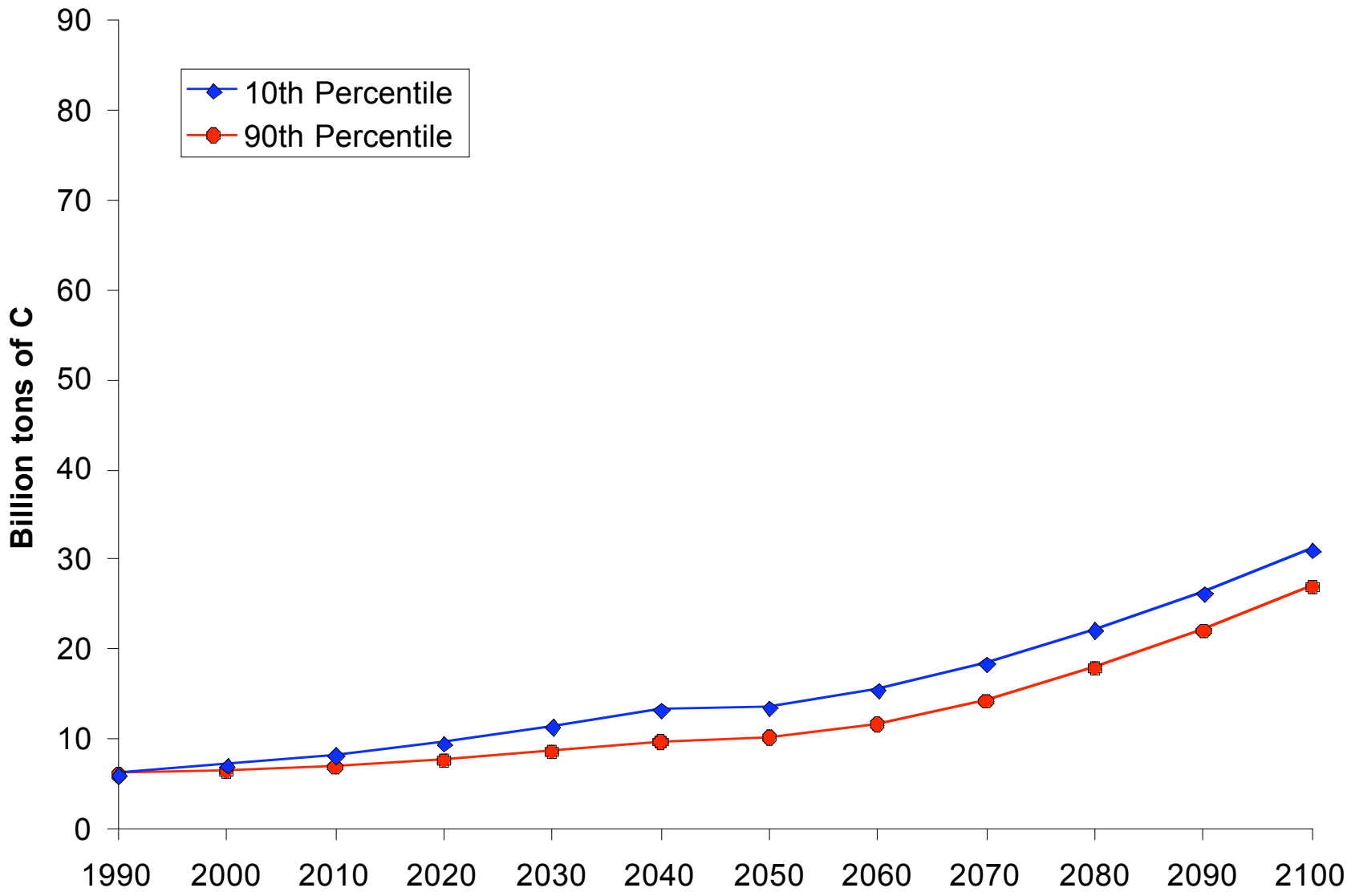
Sensitivity of Emissions to Elasticity Assumptions



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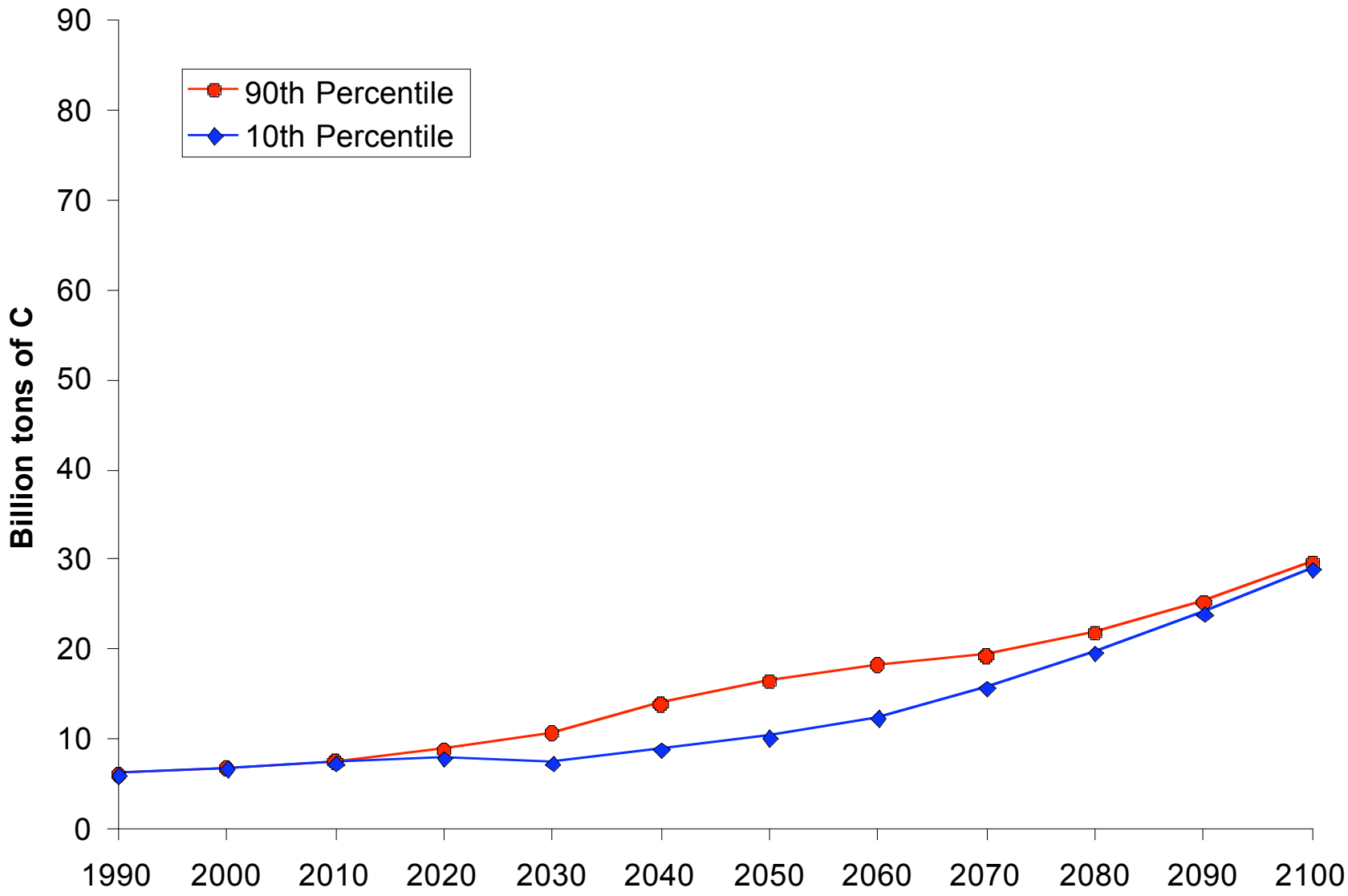
Sensitivity of Emissions to ADV-LC Timing



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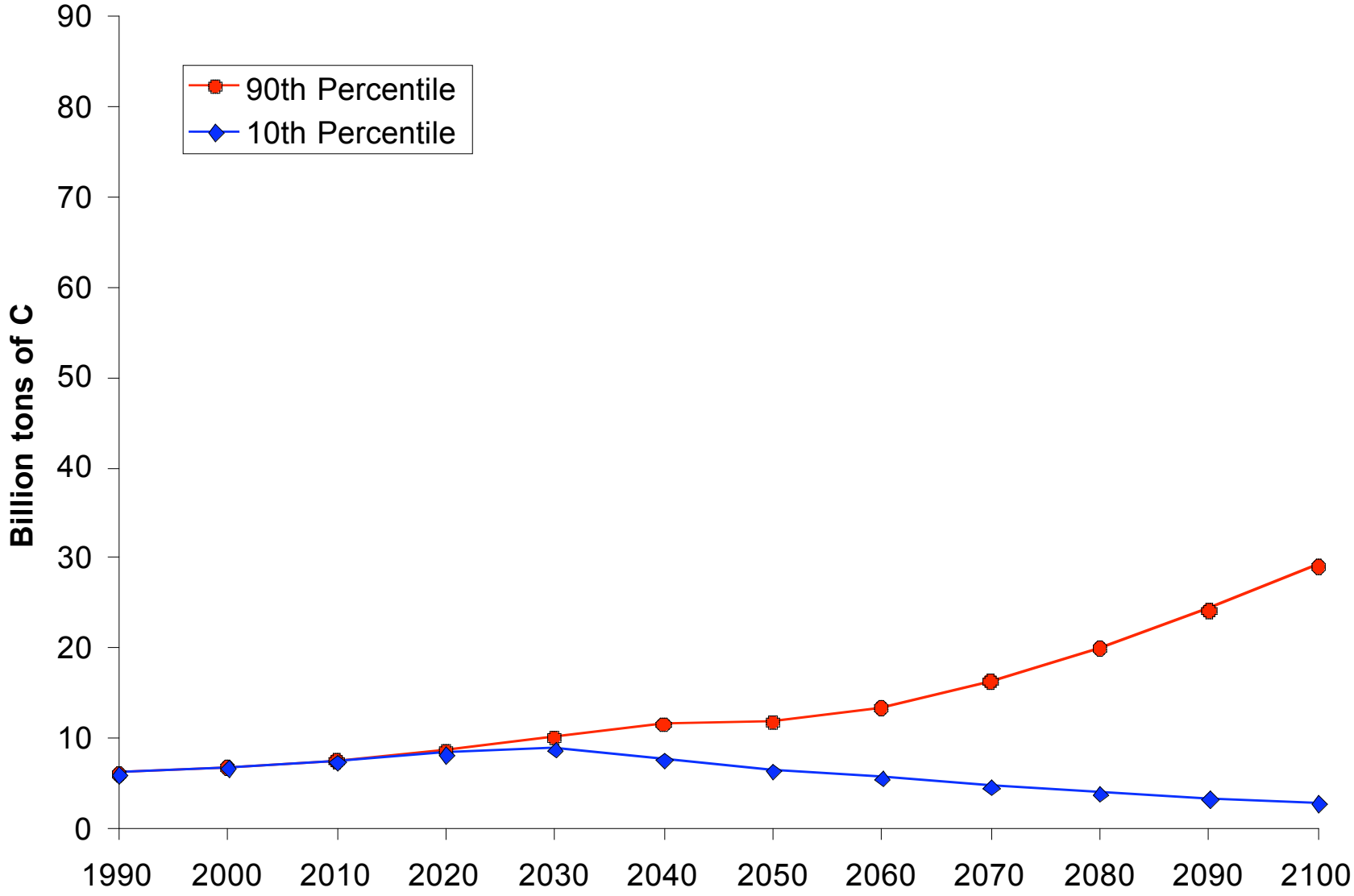
Sensitivity of Emissions to Cost of Nonelectric Backstop



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Conclusions

- Huge uncertainty in projecting future emissions
- Rate of economic growth appears to dominate
- Problem may not be as daunting as it first appears

There will be opportunity to learn and make mid-course corrections