Charge Questions 1:
Applying the Ramsey Discounting Framework in an Intergenerational Context
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• EPA Guidelines suggest that Ramsey formula can be used to determine discount rates in an intergenerational context

• Consumption rate of discount \( (r_t) = \rho + \eta \cdot g_t \)
where

  – \( \rho \) is the utility rate of discount

  – \( \eta \) measures how fast marginal utility of consumption falls as consumption grows [often assumed constant]

  – \( g_t \) is the growth rate of per-capita consumption at time \( t \)
Approaches to Choosing $\rho$ and $\eta$

- “Descriptive” approach: Choose $\rho$ and $\eta$ so that the path of $r_t$ approximates interest rates observed in the real world
- DICE model 2007: $\rho = 1.5$ and $\eta = 2$
- “Prescriptive” approach: Choose $\rho$ and $\eta$ based on ethical principles
- Stern Review: $\rho = 0.1$ and $\eta = 1$
Ramsey Discounting: DICE v. Stern
Extensions of Ramsey Formula

• Allow consumption to be uncertain (Gollier 2002)
  – Precautionary motive adds a third term to the formula
  – When rate of growth in consumption is normally distributed with mean $\mu$ and variance $\sigma^2$ and $\eta$ is constant
  – $r_t = \rho + \eta \mu - 0.5 \eta^2 \sigma^2$

• Decouple intra-generational risk aversion from inter-temporal substitutability of consumption (Gollier 2002)

• Decouple intra-generational inequality aversion from risk aversion (Antoff et al. 2009; Tol 2011)

• Allow for ambiguity aversion (Traeger 2010; Millner et al. 2010)

• Generalize to multiple goods (Heal 2010; Sterner and Persson 2008)
Applying the Ramsey Discounting Framework in an Intergenerational Context

- **Question 1:** Is it appropriate to use the Ramsey equation in either a prescriptive or descriptive fashion to generate discount rates for benefits and costs over long horizons?
- **Question 1a:** Assuming that the parameters $\eta$ and $\rho$ could be determined, how, exactly, would the Ramsey framework be used in a discounting context?
  - Is the appropriate approach to embed these parameters in a structural model (such as an Integrated Assessment Model), so that discount rates can be determined endogenously?
  - How would the Ramsey equation be used to discount streams of benefits and costs generated in a non-climate context (e.g., in evaluating the benefits of groundwater protection)?
Applying the Ramsey Discounting Framework, Cont.

- **Question 1b**: What criteria should be used to determine the parameters $\eta$ and $\rho$ of the Ramsey formula? Should they reflect ethical considerations or attempt to reproduce observable behavior in markets?

- **Question 1c**: How should uncertainty be handled in a Ramsey framework? Is it appropriate to define probability distributions over $\eta$ and $\rho$ or should sensitivity analysis be used? How should uncertainty about $g_t$ be handled?