Charge Question #5

"In keeping with Agency practice, we created the two databases by adjusting all estimates for income growth over time using an income elasticity value of 0.5 based on prior Agency reviews of the literature and results Viscusi and Aldy, 2003. …

- Does the Committee agree with this approach to accounting for income growth over time?
- Does the Committee believe the Agency should adjust its value of income elasticity for use in policy analysis in light of recent findings in the literature?
- If so, what value or range of values does the Committee believe should be used? "

Approaches to Estimating VSL Income Elasticity (η)

(*Thanks, Jim*)

- Cross-section analysis of within-sample variation in CV data
- Meta analysis of hedonic-wage studies
- Longitudinal analysis of hedonic-wage data for a particular population
- Quantile analysis of hedonic-wage data
- Comparisons of VSL estimates between poor and rich countries

Hammitt and Robinson, The Income Elasticity of the Value per Statistical Life: Transferring Estimates between High and Low Income Populations, Journal of Benefit-Cost Analysis (2011)

CV and Wage Studies

- **CV studies**
  - IEc (1999) η = 0.08 – 1.0, mode 0.4
  - Corso et al. (2001) η = 0.4
  - Alberini et al. (2004) η = 0.2 to 0.3 (> age 40)
  - Hammitt and Haninger (2010) η = 0.1 – 0.3

- **Hedonic-wage studies**
  - Viscusi and Aldy (2003)
    5 of 6 models: η = 0.46 – 0.51
  - Bellavance et al. (2009) η = 0.72 – 1.08

Longitudinal Studies

- Hammitt, Liu, and Liu (2000):
  Taiwan 1982 to 1997: $\eta = 2.0 – 3.0$
- Costa and Kahn (2004):
  US 1940 to 1980: $\eta = 1.5 – 1.7$
- Murphy and Topel (2006):
  US 1900 to 2000 (life-cycle model): $\eta = 1.33$
- Changes in both income and risk levels
- Potential confounding between changing income and risk attitudes

Quantile Analysis

- **Evans and Schaur (2010)**
  - Health and Retirement Survey; Census of Fatal Occupational Injuries
  - VSL declines with age, but value and slope depends on position in wage distribution
- **Kniesner et al. (2010)**
  - Panel Study of Income Dynamics; CFOI
  - Lowest quantile $\eta = 2.24$; highest quantile $\eta = 1.23$; mean $\eta = 1.44$

Assumptions of the simple 2-period, constant-relative-risk-aversion model

- Model requires that the relative risk coefficient in wage-risk studies be equal to η.
- By assumption:
  - VSL covariates cannot influence η
  - No individual heterogeneity in time preferences
  - Mortality risks are homogenous and exogenous
  - No probability weighting (the expected-utility hypothesis)
- If risk not exogenous (Kaplow), income elasticity $\neq \eta$

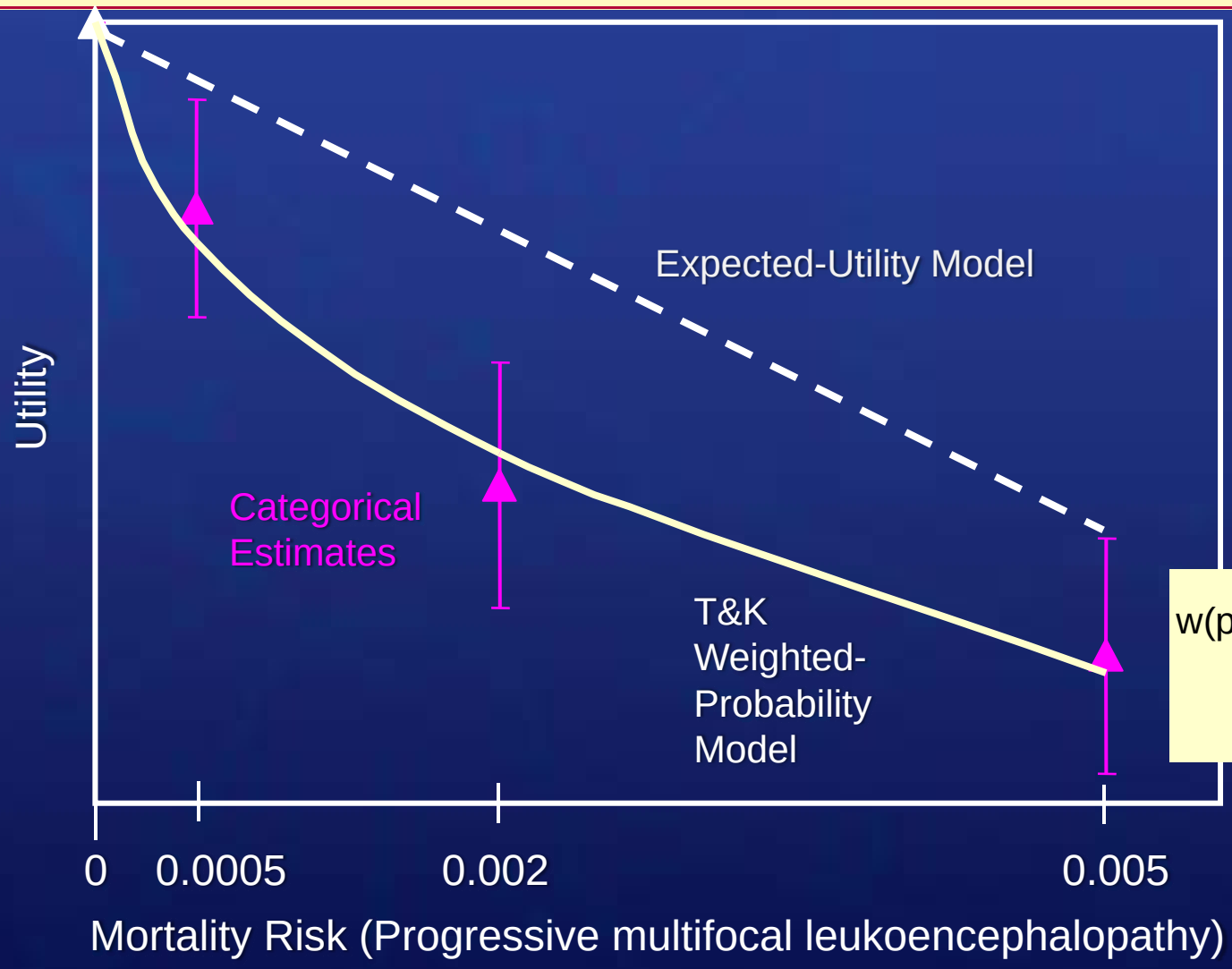
$\eta_i = \eta(Y_i, Z_i)$

- η is inversely related to income levels
- Skewed income distribution results in mean > median
- Mean-based η understates increases in VSL for lower-income groups. (But see Hammitt calculations for very low-income groups.)
- η also depends on other characteristics, such as age

Implications

- Higher incomes in CV and wage studies produce lower income elasticity estimates
- Lower incomes in longitudinal studies produce higher income elasticity estimates
- Larger η is consistent with lower income levels in longitudinal studies compared to cross-sectional studies.
- Income elasticity varies across individuals and communities

Expected Utility is Nonlinear in Probabilities



$$w(p) = \frac{p^{\gamma}}{\left[p^{\gamma} + (1-p)^{\gamma}\right]^{\frac{1}{\gamma}}}$$

$$\gamma = 0.55$$

Van Houtven et al. Eliciting benefit-risk preferences and probability-weighted utility using choice-format conjoint analysis. Med Decis Making. [In press].

General Conclusions

- Several studies reject a uniform η estimate. Heterogeneity in time preferences, incomes, age, and demographics yield varying elasticity measures.
- Studies supporting more elastic estimates relatively limited and new. Trend appears to support larger η than 0.5.
- Community variation in mean income may affect choice of η for some environmental policies.

Future Research

- If transfer function for VSL, why not transfer function for η?
- Explore non-expected utility specifications
  - Prospect theory (Tversky and Kahneman)
  - Rank-dependent utility (Gonzales and Wu, Prelec)
  - Finance literature
- What else?