Technical appendix: Valuing risk and unequal impacts

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To calculate the risk- and inequality-premiums on climate change damages, we assume that each state of the Union is composed of homogenous agents with an income equal to that state's per capita income. For each state i, we calculate the certainty-equivalent income per capita c^*, where

$$u(c_i^*) = \sum_j p_j u(c_{i,j}). \tag{E1}$$

In this expression, the indices j denote states of the world and p_j their associated probabilities. We employ an isoelastic utility function with relative risk aversion η,

$$u(c) = \frac{c^{1-\eta}}{1-\eta} \tag{E2}$$

which implies that

$$c_i^* = \left(\sum_j p_j c_{i,j}^{1-\eta}\right)^{1/(1-\eta)}. \tag{E3}$$

Note that, when $\eta = 0$, c_i^* is simply the expected income of i.

We then calculate the inequality-neutral certainty-equivalent income loss. To do this, we find the equal-percentage loss that, if forfeited by all agents with certainty, yields the same welfare as the actual cross-sectional distribution of certainty equivalent losses c_i^*. Denoting the inequality-neutral certainty-equivalent income loss as f and state populations as N_i, we compute welfare:

$$\sum_i N_i v(c_i^*) = \sum_i N_i v(c_i^0(1-f)), \tag{E4}$$

where c_i^0 is the per capita income of state i in the absence of climate impacts and the welfare function

$$\sum_i N_i v(c_i) = \sum_i N_i \frac{c_i^{1-\gamma}}{1-\gamma} \tag{E5}$$

implies that society has a coefficient of inequality aversion γ among contemporaries.

Note that when $\gamma = 0$, this reduces to

$$\sum_i N_i c_i^* = (1-f) \sum_i N_i c_i^0 \tag{E6}$$

$$f = \sum_i N_i (c_i^0 - c_i^*) / \sum_i N_i c_i^0 \tag{E7}$$

so f is simply the ratio of total certainty-equivalent damages as a fraction of total income in the absence of climate impacts. For a given value of η, the inequality premium can be defined as the difference between f computed at a selected value of γ and the same variables computed at $\gamma = 0$. Similarly, for a given value of γ, the risk premium can be defined as the difference between f computed at a selected value of η and the same variables computed at $\eta = 0$

Note also that we have intentionally chosen to compute the premium among contemporaries for unequal risk, rather than a risk premium for inequality among contemporaries. We have chosen to focus on the former

because we think it more accurately captures how society understands and practically values the impacts of climate change. Relying on the latter implies that decision-makers imagine each potential future realization of the national income distribution, weigh their aversion to each scenario independently, and then assign probabilities to each of these potential realizations. While feasible, we think latter approach is less intuitive as well as less desirable, as it ignores the private risk borne by individuals and only considers risk related to the taste for socio-economic structure in future populations.