

# Uncertainty Decomposition

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## 1 Total = SOC + CVeg

$$\begin{aligned} Var(Total) &= Var(SOC) + Var(CVeg) \\ \frac{Var(Total)}{(E(Total))^2} &= \frac{Var(SOC)}{(E(Total))^2} + \frac{Var(CVeg)}{(E(Total))^2} \\ CV^2(Total) &= \underbrace{\frac{Var(SOC)}{(E(Total))^2}}_{\% \text{ Unc SOC}} + \underbrace{\frac{Var(CVeg)}{(E(Total))^2}}_{\% \text{ Unc CVeg}} \end{aligned}$$

## 2 SOC = SOCref + FLU + FMG + FI

$$\begin{aligned} Var\left(\prod_{i=1}^4 X_i\right) &= \prod_{i=1}^4 (\sigma_i^2 + \mu_i^2) - \prod_{i=1}^4 \mu_i^2 \\ \frac{Var\left(\prod_{i=1}^4 X_i\right)}{\prod_{i=1}^4 \mu_i^2} &= \frac{\prod_{i=1}^4 (\sigma_i^2 + \mu_i^2)}{\prod_{i=1}^4 \mu_i^2} - 1 \\ CV^2\left(\prod_{i=1}^4 X_i\right) + 1 &= \prod_{i=1}^4 (1 + CV^2(X_i)) \\ \log\left(CV^2\left(\prod_{i=1}^4 X_i\right) + 1\right) &= \sum_{i=1}^4 \log(1 + CV^2(X_i)) \\ CV^2\left(\prod_{i=1}^4 X_i\right) &\approx \sum_{i=1}^4 \log(1 + CV^2(X_i)) \end{aligned}$$

## 3 Approximation of the Logarithmic Function

For *small*  $x$ ,  $\log(1 + x) \approx x$ .

In general, if  $x$  is smaller than 0,1, the approximation is practical.