Small Area Method with Benchmarking Beyond Synthetic Estimation

Aggregate national target $\Theta_t = H_t$ (from state-space model), $\underline{\theta}_{t,i}$ target Hog inventory-class vector in domain i, time t, $\rho_{t,i} = \mathbf{1}'\underline{\theta}_{t,i}/\Theta_t$ is survey fraction in domain i modeled as

$$\text{logit}(\rho_{t,i}) = b_t'\mathbf{X}_{t,i} + a_{t,i} + e_{t,i} \quad , \qquad a_{t,i} \sim (0, \sigma^2) \quad AR(1)?$$

where covariate $\mathbf{X}_{t,i}$ includes (logit) pork-checkoff slaughter fraction in domain i , maybe also state disease indicator

Assume same fraction applies to all Hog-inventory classes;

$V(e_{t,i})$ **known from survey variances. Benchmark** $\sum_i \widehat{\rho}_{t.i}$ **to** 1.

Rao and Molina (2015), *Small Area Estimation*, 2nd ed.