CENTRAL LIMIT THEOREM

"additive random process produce a sum which is normally distributed"

What about a product of random processes?

$$P = \prod_{i=1}^{n} x_j$$

$$\ln P = \sum_{i=1}^{n} \ln x_j$$

normally distributed

Calculating $Var(\hat{\lambda})$
From PVAX (SIM)
output

Set time horizon to 1,
and N_0 we can get
mean(N_1) and std.(N_1)

$$\lambda_{N_0} = \frac{N_1}{N_0}$$

$$\mathrm{Var}(\lambda_{N_0}) = \mathrm{Var}\left(\frac{N_1}{N_0}\right)$$

$$= \frac{1}{N_0^2} \mathrm{Var}(N_1)$$

$$= \frac{1}{N_0^2} \left(\mathrm{std}(N_1)\right)^2$$

$$= \left(\frac{\mathrm{std}\, N_1}{N_0}\right)^2$$

Application for comparing demographic stochasticity and environmental stochasticity secanios:

I. Pick a scenario for demographic stochasticity

a) what is $\bar{\lambda}$ and σ_λ^2 at reference N_r ?

b) how does that compare to $\bar{\lambda}$ and σ_λ^2 at $N = 2N_r$?

II Create an environmental stochasticity scenario that at N_r has same $\bar{\lambda}$ and $Var(\lambda)$ that scenario I. did.

(trial and error to adjust std(B))

a) What is $Var(\lambda)$ at $N = 2N_r$?

Pick $N_{Q_x} = 10$

With model I,

what is $P(Q_x | N_r)$?

what is $P(Q_x | N = 2N_r)$?

With model II ("tuned")

what is $P(Q_x | N_r)$?

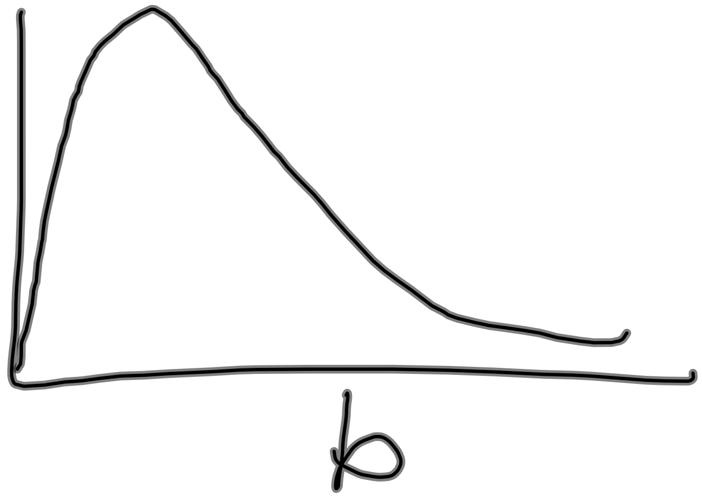
$P(Q_x | N = 2N_r)$?

Parameter Uncertainty

let's say our uncertainty is about $\underline{b}$. (we know a exactly) ignore demographic and environmental stochasticity.

Say error distribution is a known family, e.g. lognormal

Represent uncertainty about b as lognormal distribution with mean $\bar{b}$ and σ_b.



PVA

trials

sample uncertainty

time steps for each trajectory

Effect compounds (geometric) with time in each trajectory