S1 Methods. Unbiasedness of growth rate.

Denote our estimator for growth rate of the type-i clone $\widehat{r}_i$, with true parameter value r_i. The type-i population has size $X_i(t)$ at time t. Then,

$$bias(\widehat{r}_i) = \mathbb{E}(\widehat{r}_i) - r_i \tag{1}$$

$$= \frac{1}{\Delta}\mathbb{E}\log\left(\frac{X_i(t_{dx}+\Delta)}{X_i(t_{dx})}\right) - r_i \tag{2}$$

$$\approx \frac{1}{\Delta}\left(r_i\Delta + \mathbb{E}\log\ U - \mathbb{E}\log V\right) - r_i \tag{3}$$

$$= \frac{1}{\Delta}(r_i\Delta + (\gamma + \log r_i) - (\gamma + \log r_i)) - r_i \tag{4}$$

$$= 0 \tag{5}$$

where U and V are i.i.d. $\text{Exp}(r_i/b_i)$, and t_{dx} is the time of diagnosis.