

$$\int \prod_{k' \neq k} \pi e^{-e^{-(z_{k'} - \gamma_{k'})}} \cdot e^{-(z_k - \gamma_k)} \cdot e^{-(z_k - \gamma_k)} dz_k$$

$$= \int e^{-\sum_{k' \neq k} e^{-(z_{k'} - \gamma_{k'})}} \cdot e^{-(z_k - \gamma_k)} \cdot e^{-(z_k - \gamma_k)} dz_k$$

$$= \int e^{-\sum_{k'} e^{-(z_k - \gamma_{k'})}} \cdot e^{-z_k + \gamma_k} dz_k$$

$$= \int e^{-\left(\sum_{k'=1}^K e^{\gamma_{k'}}\right) e^{-z_k}} \cdot e^{-z_k + \gamma_k} dz_k$$

$$= \int e^{-e^{-z_k + \ln\left(\sum_{k'=1}^K e^{\gamma_{k'}}\right)}} \cdot e^{-z_k + \gamma_k} dz_k \quad \cancel{\sum_{k'=1}^K e^{\gamma_{k'}}} \quad \frac{1}{2} M = \ln\left(\sum_{k'=1}^K e^{\gamma_{k'}}\right)$$

$$= \int e^{-e^{-z_k + M}} \cdot e^{-z_k + \gamma_k} dz_k$$

$$= \int e^{-e^{-(z_k - M)}} \cdot e^{-(z_k - M) - M + \gamma_k} dz_k$$

$$= e^{-M + \gamma_k} \cdot \int e^{-(z_k - M)} \cdot e^{-e^{-(z_k - M)}} dz_k$$

$$= \frac{e^{\gamma_k}}{e^M} \cdot 1$$

$$= \frac{e^{\gamma_k}}{\sum_{k'=1}^K e^{\gamma_{k'}}}$$