$$
\begin{aligned}
&P(c_{ij}=c_p|z_{ij}=k,t_{ij}=t,c_{-ij},s',z_{-ij},t_{-ij},.)\\
&=\frac{P(c,s'|\rho)}{P(c_{-ij},s'|\rho)}\frac{P(z|c,\alpha)}{P(z|c_{-ij},\alpha)}\frac{P(t|c,z,\epsilon)}{P(t|c_{-ij},z,\epsilon)}\\
&\propto\frac{n_i^{(c_p)}+\rho}{n_i^{(\cdot_p)}+C\rho}\frac{n_{c_p}^{(k)}+\alpha}{n_{c_p}^{(\cdot)}+K\alpha}\frac{t_{ij}^{\psi_{c_pk0}-1}\cdot(1-t_{ij})^{\psi_{c_pk1}-1}}{B(\psi_{c_pk0},\psi_{c_pk1})}
\end{aligned}
$$

$$
\begin{aligned}
&P(z_{ij}=k|c_{ij}=c_p,t_{ij}=t,c_{-ij},z_{-ij},t_{-ij},.)\\
&=\frac{P(z|c,\alpha)}{P(z_{-ij}|c,\alpha)}\frac{P(t|c,z,\epsilon)}{P(t|c,z_{-ij},\epsilon)}\frac{P(w|z,\beta)}{P(w|z_{-ij},\beta)}\\
&\propto\frac{n_{c_p}^{(k)}+\alpha}{n_{c_p}^{(\cdot)}+K\alpha}\frac{t_{ij}^{\psi_{c_pk0}-1}\cdot(1-t_{ij})^{\psi_{c_pk1}-1}}{B(\psi_{c_pk0},\psi_{c_pk1})}\frac{\prod_{v=1}^{V}\prod_{q=0}^{n_{ij}^{(v)}}(n_k^{(v)}+q+\beta)}{\prod_{q=0}^{n_{ij}^{(\cdot)}}(n_k^{(\cdot)}+q+\beta)}
\end{aligned}
$$

$$
\begin{aligned}
&P(s_{ii'}=c_i,s'_{ii'}=c_p|e_{ii'}=1,s_{-ii'},c,e,.)\\
&=\frac{P(s|\sigma)}{P(s_{-ii'}|\sigma)}\frac{P(c,s'|\rho)}{P(c,s'_{-ii'}|\rho)}\frac{P(e|s,s',\lambda)}{P(e|s_{-ii'},s'_{-ii'},\lambda)}\frac{P(t|s,\delta)}{P(t|s_{-ii'},\delta)}\frac{P(t'|s',\gamma)}{P(t'|s'_{-ii'},\gamma)}\\
&\propto\frac{n_i^{(c_i)}+\sigma}{n_i^{(\cdot_i)}+C\sigma}\frac{n_{i'}^{(c_p)}+\rho}{n_{i'}^{(\cdot_p)}+C\rho}\frac{\lambda_0+n_{c_ic_p}}{\lambda_0+\lambda_1+n_{c_ic_p}}\prod_{t_{ii'm}}\frac{t_{ii'm}^{\delta_{ic_i0}-1}(1-t_{ii'm})^{\delta_{ic_i1}-1}}{B(\delta_{ic_i0},\delta_{ic_i1})}\prod_{t'_{ii'm}}\frac{{t'}_{ii'm}^{\gamma_{i'c_p0}-1}(1-{t'}_{ii'm})^{\gamma_{i'c_p1}-1}}{B(\gamma_{i'c_p0},\gamma_{i'c_p1})}
\end{aligned}
$$

$$
\begin{aligned}
\psi_{c_pk0}&=\bar{t}_{c_pk}\left(\frac{\bar{t}_{c_pk}(1-\bar{t}_{c_pk})}{s_{c_pk}^2}-1\right)\\
\psi_{c_pk1}&=(1-\bar{t}_{c_pk})\left(\frac{\bar{t}_{c_pk}(1-\bar{t}_{c_pk})}{s_{c_pk}^2}-1\right)
\end{aligned}
$$

$$
\begin{aligned}
\delta_{ic_i0}&=\bar{t}_{ic_i}\left(\frac{\bar{t}_{ic_i}(1-\bar{t}_{ic_i})}{s_{ic_i}^2}-1\right)\\
\delta_{ic_i1}&=(1-\bar{t}_{ic_i})\left(\frac{\bar{t}_{ic_i}(1-\bar{t}_{ic_i})}{s_{ic_i}^2}-1\right)
\end{aligned}
$$

$$
\begin{aligned}
\psi_{i'c_p0}&=\bar{t}_{i'c_p}\left(\frac{\bar{t}_{i'c_p}(1-\bar{t}_{i'c_p})}{s_{i'c_p}^2}-1\right)\\
\psi_{i'c_p1}&=(1-\bar{t}_{i'c_p})\left(\frac{\bar{t}_{i'c_p}(1-\bar{t}_{i'c_p})}{s_{i'c_p}^2}-1\right)
\end{aligned}
$$