Supporting Information for *Non-random network connectivity comes in pairs*

Felix Z. Hoffmann, Jochen Triesch

SI1

Solving

$$\mu = px + (1-p)y \tag{1}$$

for p gives

$$p = \frac{\mu - y}{x - y}, \tag{2}$$

which, plugged into

$$\varrho = \frac{px^2 + (1-p)y^2}{\mu^2}, \tag{3}$$

yields

$$\begin{align}
\varrho &= \frac{\left(\frac{\mu-y}{x-y}\right)x^2 + \left(1 - \frac{\mu-y}{x-y}\right)y^2}{\mu^2} \tag{4}\\
&= \underbrace{\frac{(\mu-y)x^2}{(x-y)\mu^2}}_{\text{(I)}} + \underbrace{\frac{y^2}{\mu^2}}_{\text{(II)}} - \underbrace{\frac{(\mu-y)y^2}{(x-y)\mu^2}}_{\text{(III)}}. \tag{5}
\end{align}$$

The summands are

$$\begin{align}
\text{(I)}: &\quad \frac{(\mu-y)x^2}{(x-y)\mu^2} = \frac{x^2}{(x-y)\mu} - \frac{yx^2}{(x-y)\mu^2} \tag{6}\\
\text{(II)}: &\quad \frac{y^2}{\mu^2} = \frac{(x-y)y^2}{(x-y)\mu^2} = \frac{xy^2}{(x-y)\mu^2} - \frac{y^3}{(x-y)\mu^2} \tag{7}\\
\text{(III)}: &\quad -\frac{(\mu-y)y^2}{(x-y)\mu^2} = \frac{y^3}{(x-y)\mu^2} - \frac{y^2}{(x-y)\mu} \tag{8}
\end{align}$$

Putting everything together we get

$$\begin{align}
\varrho &= \frac{x^2 - y^2}{(x-y)\mu} + \frac{xy^2 - yx^2}{(x-y)\mu^2} = \frac{(x+y)(x-y)}{(x-y)\mu} - \frac{xy(x-y)}{(x-y)\mu^2} \tag{9}\\
&= \frac{x+y}{\mu} - \frac{xy}{\mu^2}. \tag{10}
\end{align}$$

SI2

Solve

$$p = \frac{\mu - y}{x - y} \tag{11}$$

for y and since $x \geq \mu$,

$$y = \frac{\mu - px}{1 - p} \leq \frac{\mu - p\mu}{1 - p} = \mu. \tag{12}$$