Supplemental Material S3 Text: Motif plasticity in homogenous networks

If all neurons have the same weighted in- and out-degrees, then the motif dynamics simplify considerably. In such a homogenous network, divergent motifs obey:

$$\begin{aligned}
\frac{dq^{\text{div}}}{dt} &= \frac{2}{N^3} \sum_{i,j,k} \mathbf{W}_{ik} \frac{d\mathbf{W}_{jk}}{dt} - 2p \frac{dp}{dt} \\
&= \frac{2}{N^3} \sum_{k} \left(\sum_{i} \mathbf{W}_{ik} \sum_{j} \frac{d\mathbf{W}_{jk}}{dt} \right) - 2p \frac{dp}{dt} \\
&= \frac{2}{N^3} Np \sum_{j,k} \frac{d\mathbf{W}_{jk}}{dt} - 2p \frac{dp}{dt} \\
&= 2p \frac{dp}{dt} - 2p \frac{dp}{dt} = 0
\end{aligned} \tag{1}$$

Convergent and chain motifs are also neutrally stable. So, it is inhomogeneities in the network structure that give rise to drift of the motif structure.